

MACHINERY

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SHOP PRACTICE

High-Speed Short-Run Production on Automatic Bar Machines <i>By George H. DeGroat</i>	133
Blanking and Piercing Small Lots by Low-Cost Methods <i>By D. A. Rogers</i>	140
Versatile Tooling Used in Building Road Machinery <i>By K. A. Long</i>	144
Automatic Tracer-Duplicator Controls Contour Machining on Vertical Lathes	152
Contour Sawing Made Easy by the Use of Fixtures	160
Producing Wright Aircraft Engines with High-Production Equipment <i>By George H. DeGroat</i>	168
Making Dovetail Measurements (Data Sheet)	229

MACHINE AND TOOL DESIGN

Automatic Lubricating System for Punch Presses <i>By Alfred Duglin</i>	158
Design of Internal Broaches <i>By J. R. Paquin</i>	165
Selecting Anti-Friction Bearings for Machine Tools <i>By John H. Baninger</i>	181
Hydraulically Operated Double-Draw Die <i>By L. D. Richards</i>	185
V-Block Jig Simplifies Drilling of Aligned Holes <i>By H. Moore</i>	186
Fixture for Machining Tapered Keyways on a Shaper <i>By L. L. Walker</i>	187
Holding Guide Pins by Friction Eliminates Mechanical Fasteners <i>By L. Kasper</i>	188

MANAGEMENT PROBLEMS

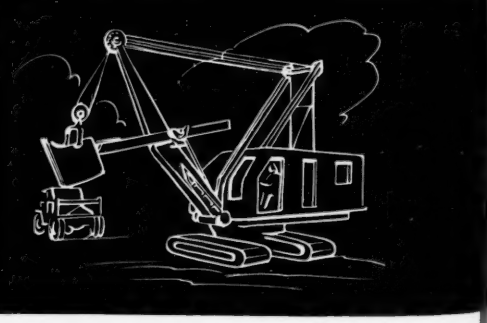
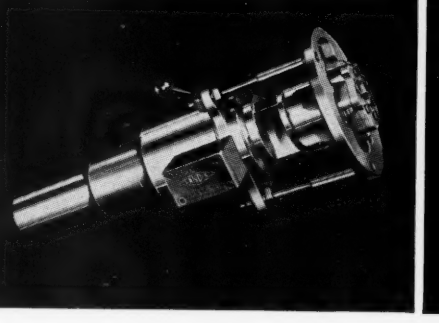
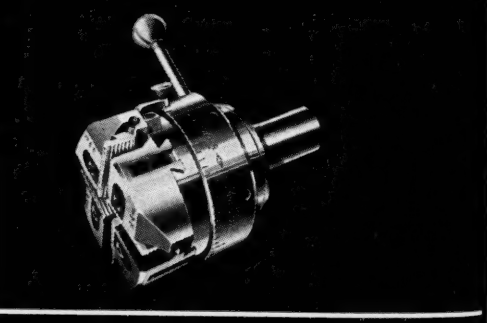
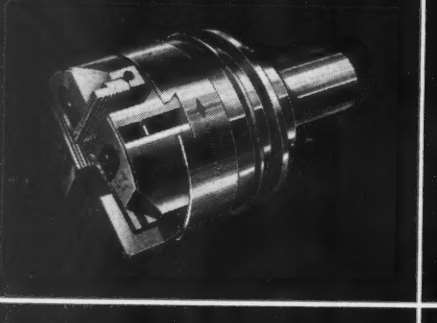
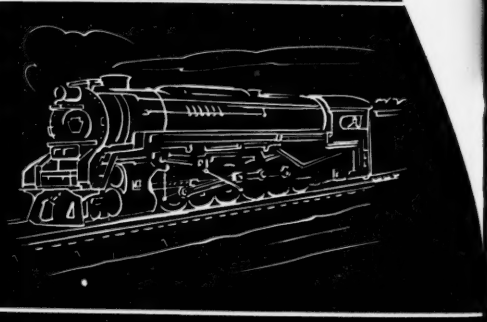
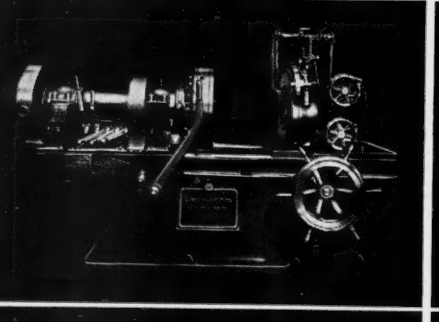
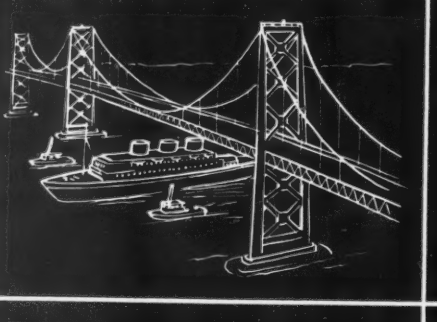
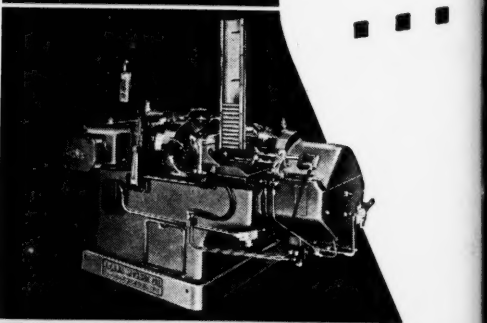
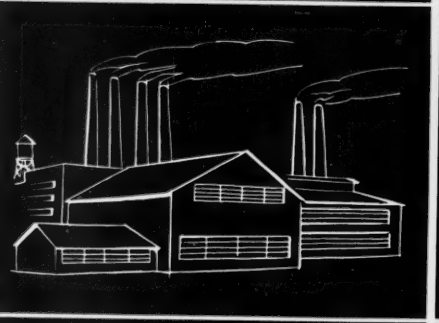
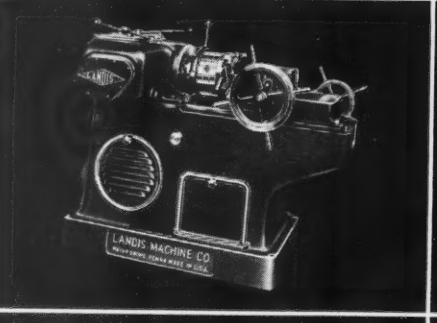
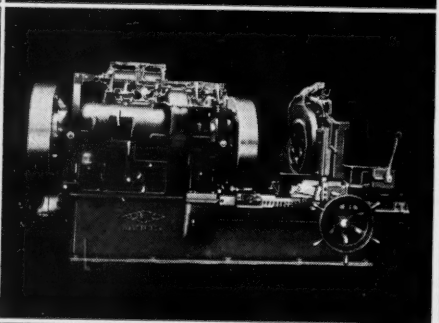
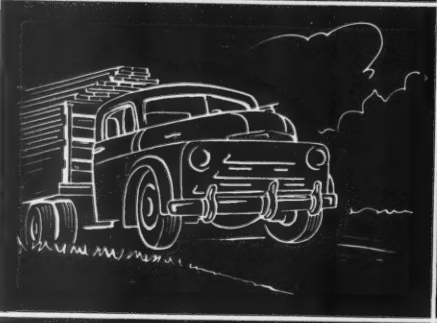
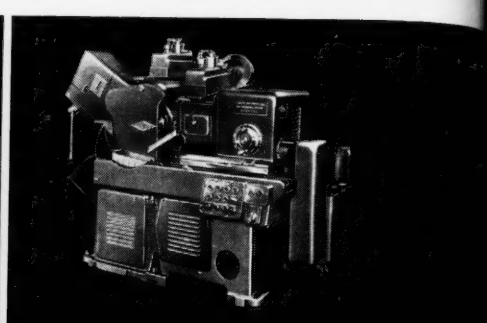
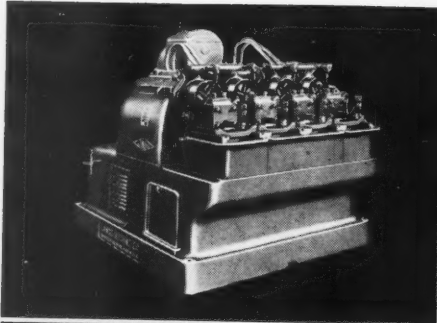
The Mid-Century Year Looks Promising <i>By Charles O. Herb</i>	149
Where Machine Tools are Sold	150
Technical Contributions Toward Peace Discussed at A.S.M.E. Convention	154
How to Estimate Costs of Lathe Operations in the Job Shop <i>By Herbert W. Brown</i>	173
The Sales Engineer and His Problems—The 1950 Yard Stick <i>By Bernard Lester</i>	189

DEPARTMENTS

Engineering News	156	Shop Equipment News	191
Materials of Industry	178	New Trade Literature	218
Questions and Answers	184	Between Grinds	225
Tool Engineering Ideas	185	Data Sheet	229
The Sales Engineer	189	News of the Industry	231

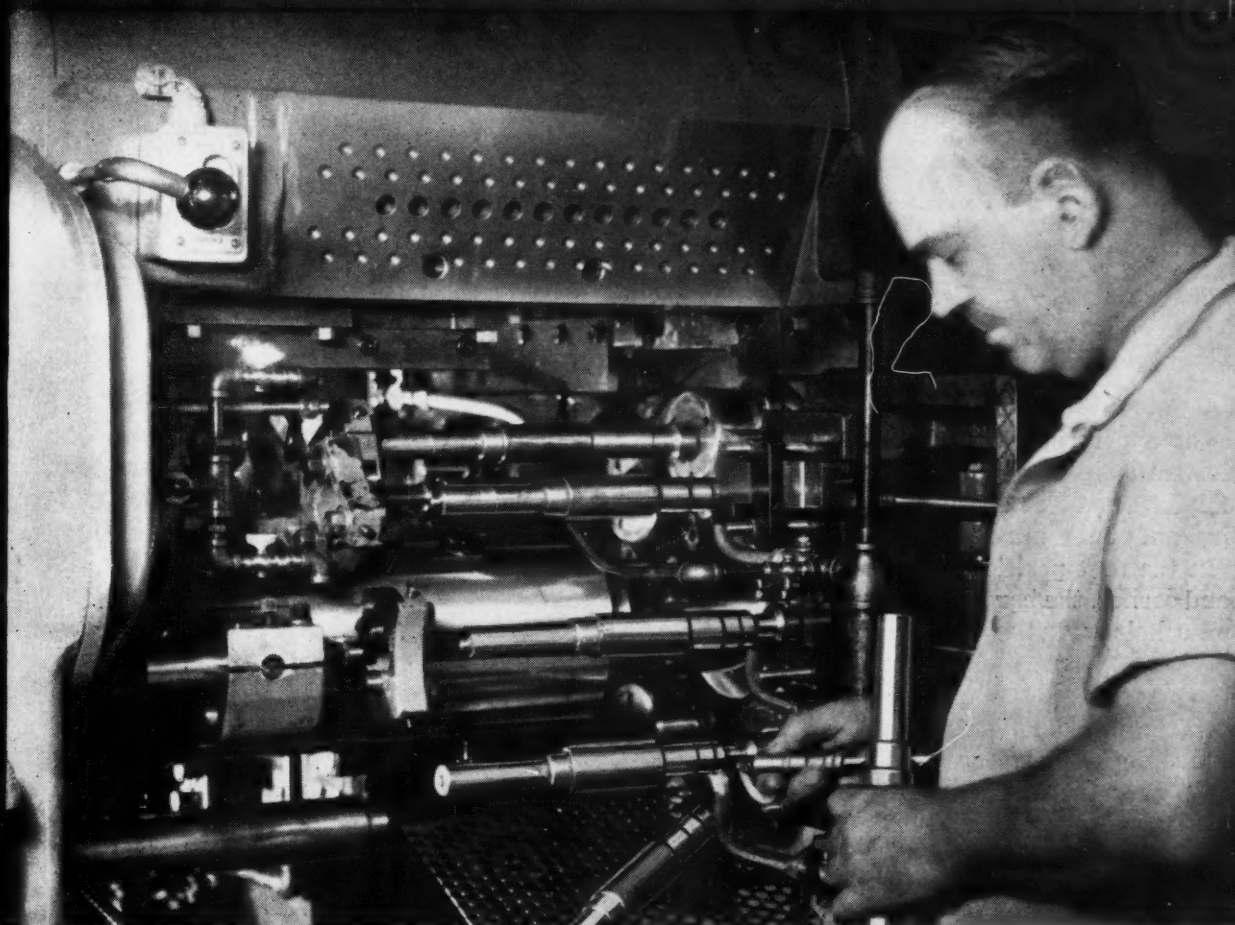
Product Index
303-333

Advertisers Index
335-336



MACHINERY

Vol. 56 JANUARY, 1950 No. 5



High-Speed Short-Run Production on Automatic Bar Machines

By GEORGE H. DeGROAT

MULTIPLE-SPINDLE, automatic bar machines are widely used for the short-run production of parts made from bar stock, as well as for producing parts in large quantities. Among the advantages gained by the use of these machines are high production rates, the elimination of secondary operations, and accurate work without the constant attention of skilled operators.

Recently developed machines of this type are equipped to facilitate setting up new jobs, so that comparatively small quantities of various parts can be made economically. A typical example of short-run jobs produced on multiple-spindle automatic machines is shown in Fig. 1. The plate A

in this illustration was produced after changing over from the production of a small quantity of nuts such as that shown at B. The difference in the design of these parts is such as to necessitate more work in changing set-ups than is usually required. These parts, and others that will be described in this article, were made on Conomatic automatic bar machines built by the Cone Automatic Machine Co., Inc., Windsor, Vt.

A 5-inch four-spindle Conomatic was used for producing these pieces. The nut was machined from 2 3/4-inch diameter cold-drawn steel bars, (S A E 1112) at a cutting speed of 315 surface feet per minute, using carbide tools. Dimensional details and tolerances are given in the part sketch

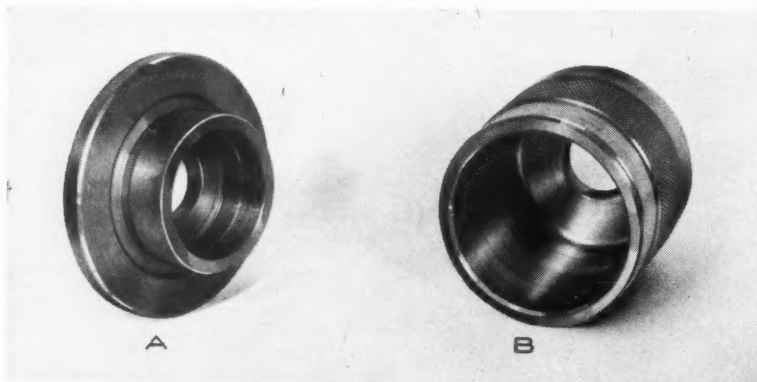


Fig. 1. Two parts of entirely different design that were produced on the same four-spindle Conomatic by a comparatively simple change-over of the machine

at the upper right-hand corner of Fig. 2. This illustration also shows the tooling lay-out for the four different spindle positions indicated by the diagram at the upper left-hand corner.

In the first position, shown in the lower left-hand corner, the bar is turned with a knee-turner and a hole is drilled in the end, using a feed of 0.010 inch per revolution for both operations. A knurling tool, held on the cross-slide, is in contact with the bar during only one revolution of the work-spindle. This cross-slide action occurs at the high point of its actuating cam during the rapid traverse of the camshaft, thus providing a quick withdrawal of the knurling tool.

In the second spindle position, a larger drill is employed to increase the diameter of the hole in the end of the bar, using a feed of 0.010 inch per revolution, while a flat form tool forms two radii and an angle, turns the outside diameter to 2.625 inches at the drilled end, and faces that end at a feed of 0.0011 inch per revolution. A knee-turner, operating between the flutes of the drill, chamfers the work at a 45-degree angle for 1/16 inch.

The drilled end is counterbored to a diameter of 2.298 inches in the third position, using a feed of 0.010 inch per revolution. A flat form tool, fed at 0.0015 inch per revolution, reduces the outside diameter at the cut-off end to 2.625 inches and produces a 1/4-inch radius.

The small hole in the cut-off end of the part is produced by a 29/32-inch drill in the fourth position, held on the main end slide. This drill is actuated independently by an auxiliary lever and cam-roll operated from the camshaft. A feed of 0.0046 inch per revolution is used for this operation, after which the finished nut is severed from the bar by a cut-off blade at a feed of 0.0029 inch per revolution. These nuts were produced at the rate of ninety pieces per hour, or one every 40 seconds.

Changing the set-up of the machine for producing the plate A shown in Fig. 1 was comparatively simple because of the design of the machine and tooling. The form tool-holders are secured in slots in the cross-slide by clamps against tapered axial adjustment wedges, the slots being so positioned relative to the axis of the work-spindles that the top of the holder can be used as a locating surface for centering the tools with the work. When the cutting edge of a form tool is flush with the top of the holder, it is centered on the work.

An experienced operator dismantled the machine as set up for the nut job, including the removal of the bar stock from the stock reel, in eleven minutes. The total time required for the change-over to the set-up for making the plate was approximately five hours.

With the new set-up, the plates were completely machined as shown by the part sketch in Fig. 3 at a rate of forty pieces an hour. The stock used consisted of silicon-manganese steel bars (SAE 9140), 3 3/8 inches in diameter, which were machined at a cutting speed of 116 surface feet per minute with high-speed steel tools.

In the first position shown in the tooling layout, Fig. 3, it can be seen that a forming and facing tool with two blades is employed to reduce the bar diameter at the cut-off end while it faces and chamfers the back of the flange and also faces the drilled end of the bar. A feed of 0.002 inch per revolution is used for this tool. At the same time, a hole is drilled in the end of the bar by a sub-land step drill and the flange diameter is turned by a knee-turner at a feed of 0.007 inch per revolution. These tools may be seen in Fig. 4, where the first-position main end slide is shown at A.

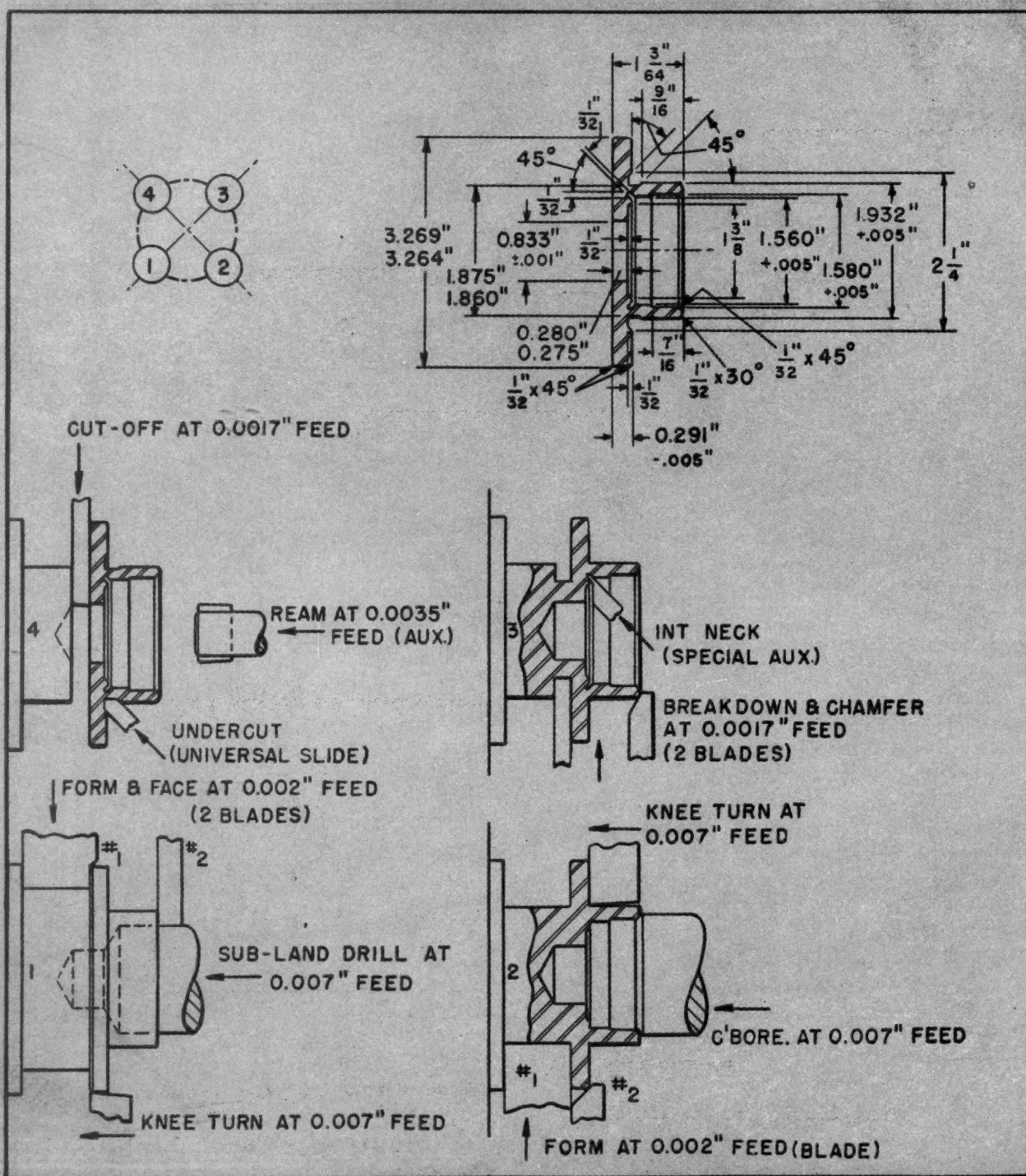
The outside diameter of the bar (previously reduced in the first position) is turned at the drilled end in the second position by means

per revolution, while the plate is under-cut at the intersection of the flange and the body. The universal slide on which the under-cutting tool is mounted is shown at *B* in Fig. 4. The cut-off tool used for the final operation is fed to the bar at 0.0017 inch per revolution.

1 7/8-inch eight-spindle Conomatic. It is machined from 3/4-inch diameter steel bar (SAE 4130) at a cutting speed of 125 surface feet per minute, by high-speed steel tools.

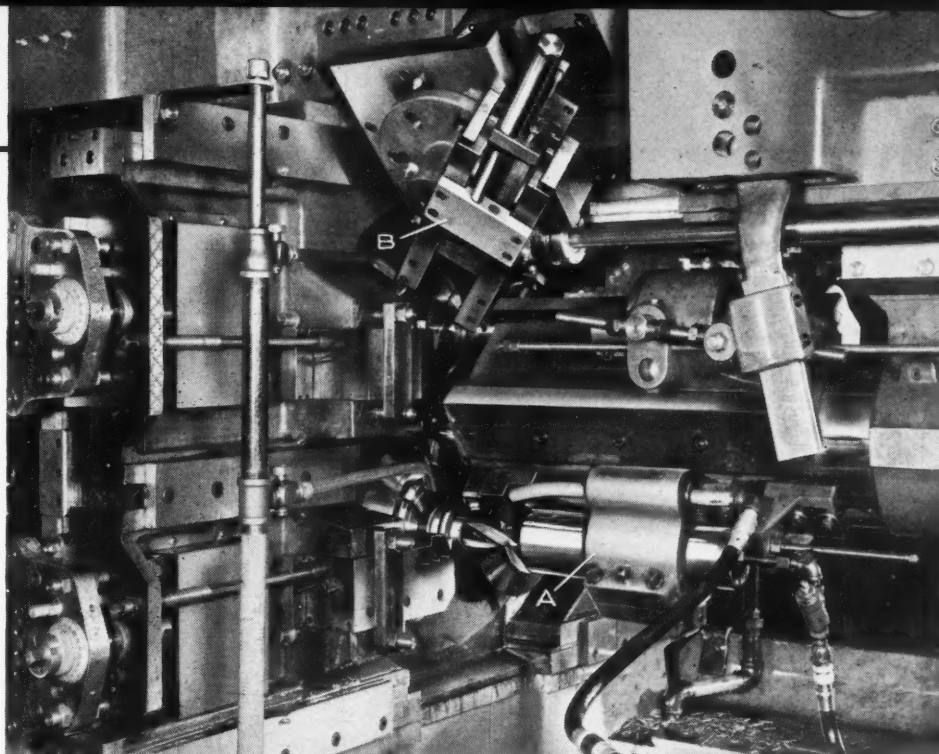
A special stock feed is used to feed the bar out in the first position (Fig. 7), after which the bar is indexed to the second position for spot-drilling. A three-roll support is employed at the drilled end of the bar during this operation and in the third, fourth, and fifth positions.

Fig. 3. Tooling lay-out for machining the plate illustrated at (A) in Fig. 1 on the same four-spindle Conomatic in which the nuts (B), Fig. 1, were produced



MACHINES

Fig. 4. View showing tooling equipment at first and fourth positions of a four-spindle Conomatic set up to produce the plate (A), Fig. 1. The first-position main end slide is shown at (A), and a universal slide that actuates an under-cutting tool in the fourth position can be seen at (B)



In the third position, two form tools on an auxiliary cross-slide rough-form and reduce the center section of the bar. The tools are fed into the work at 0.002 inch per revolution and have a longitudinal feed of 0.006 inch per revolution. While these operations are being performed, a drill is fed into the end of the bar at a rate of 0.001 inch per revolution.

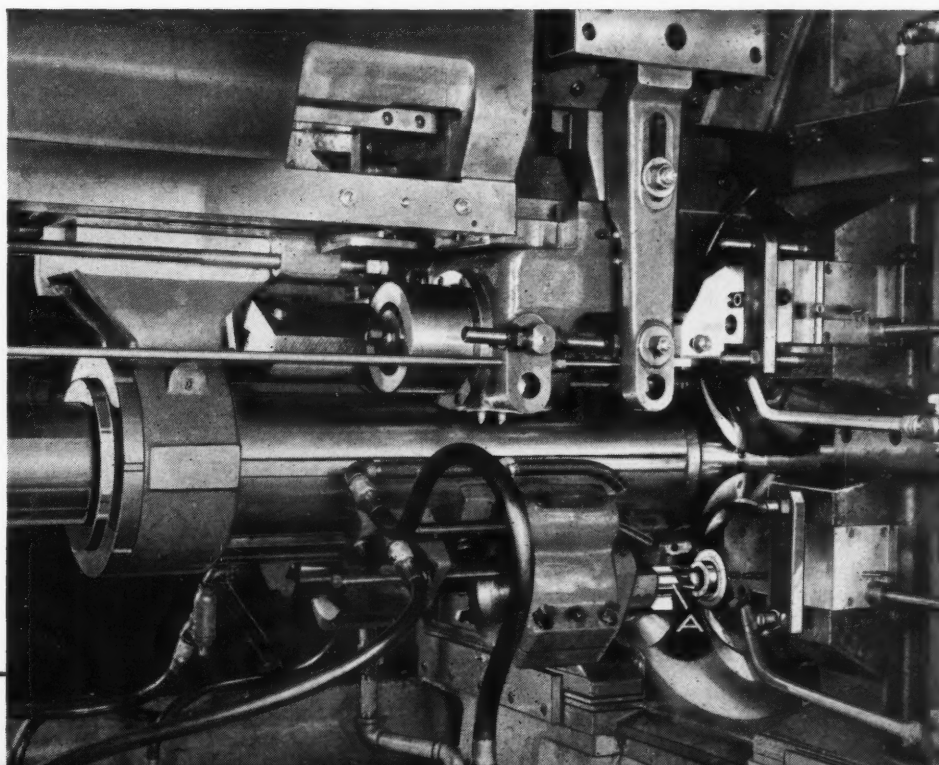
A form tool, in the fourth position, reduces the diameter of the cut-off end, chamfers the drilled end of the next succeeding bar, and turns a radius on the bar. The feed of this tool is 0.002 inch per revolution. At the same time the previously drilled end of the work is step-drilled at a feed of 0.001 inch per revolution.

In the fifth position, an internal necking tool is fed into the work at a feed of 0.001 inch

per revolution to produce a recess at the bottom of the largest drilled hole. This hole is counter-bored in the sixth position, using a feed of 0.001 inch per revolution, and, at the same time, three form tools finish-form the section rough-formed in the third position and produce a radius on the end of the bar. The form tools are fed into the work at the rate of 0.0005 inch per revolution.

In the seventh position, a diamond knurling tool on an auxiliary slide is employed to knurl the drilled end of the bar while a forming and cut-off tool neck the opposite end preparatory to severing the wrench handle from the bar. The cutting-off operation is accomplished in the eighth position with a formed cut-off tool which is fed into the work at 0.0005 inch per revolution.

Fig. 5. In the foreground is shown the tooling equipment used at second position of the same set-up on the Conomatic illustrated in Fig. 4. A counter-boring operation is being performed at (A)



HIGH-SPEED SHORT-RUN PRODUCTION ON BAR MACHINES

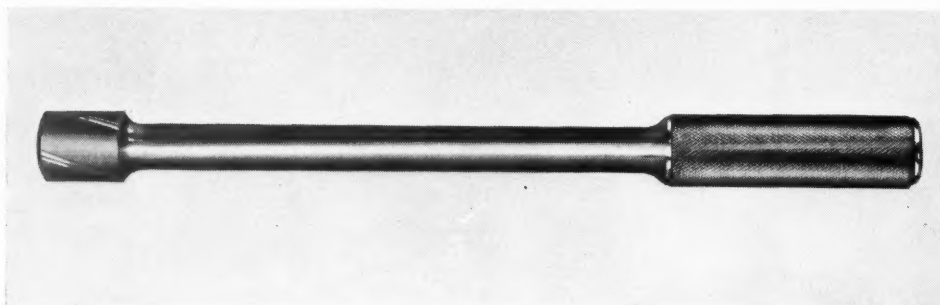


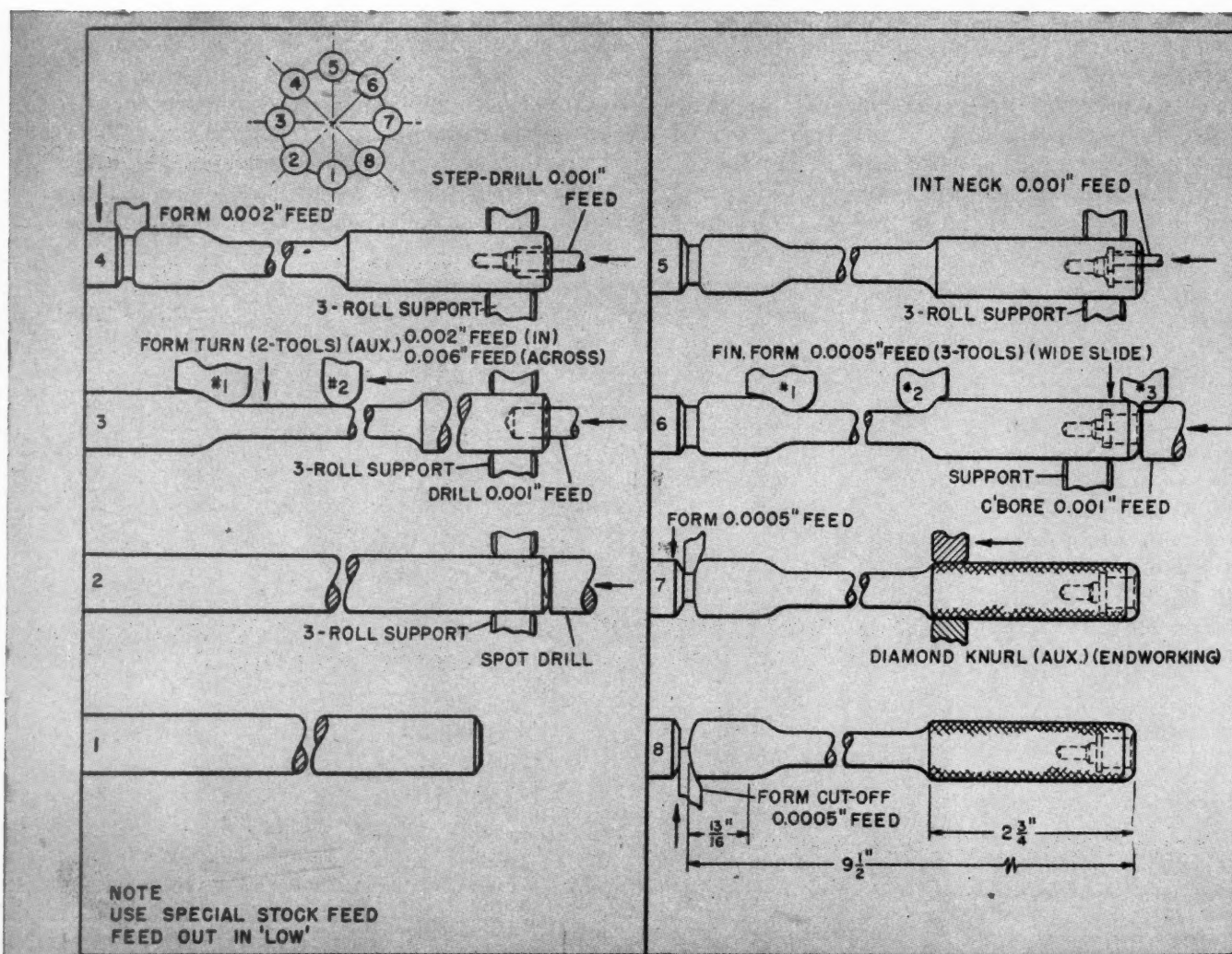
Fig. 6. Wrench handle produced on a 1 7/8-inch eight-spindle Conomatic at rate of sixty-five pieces an hour

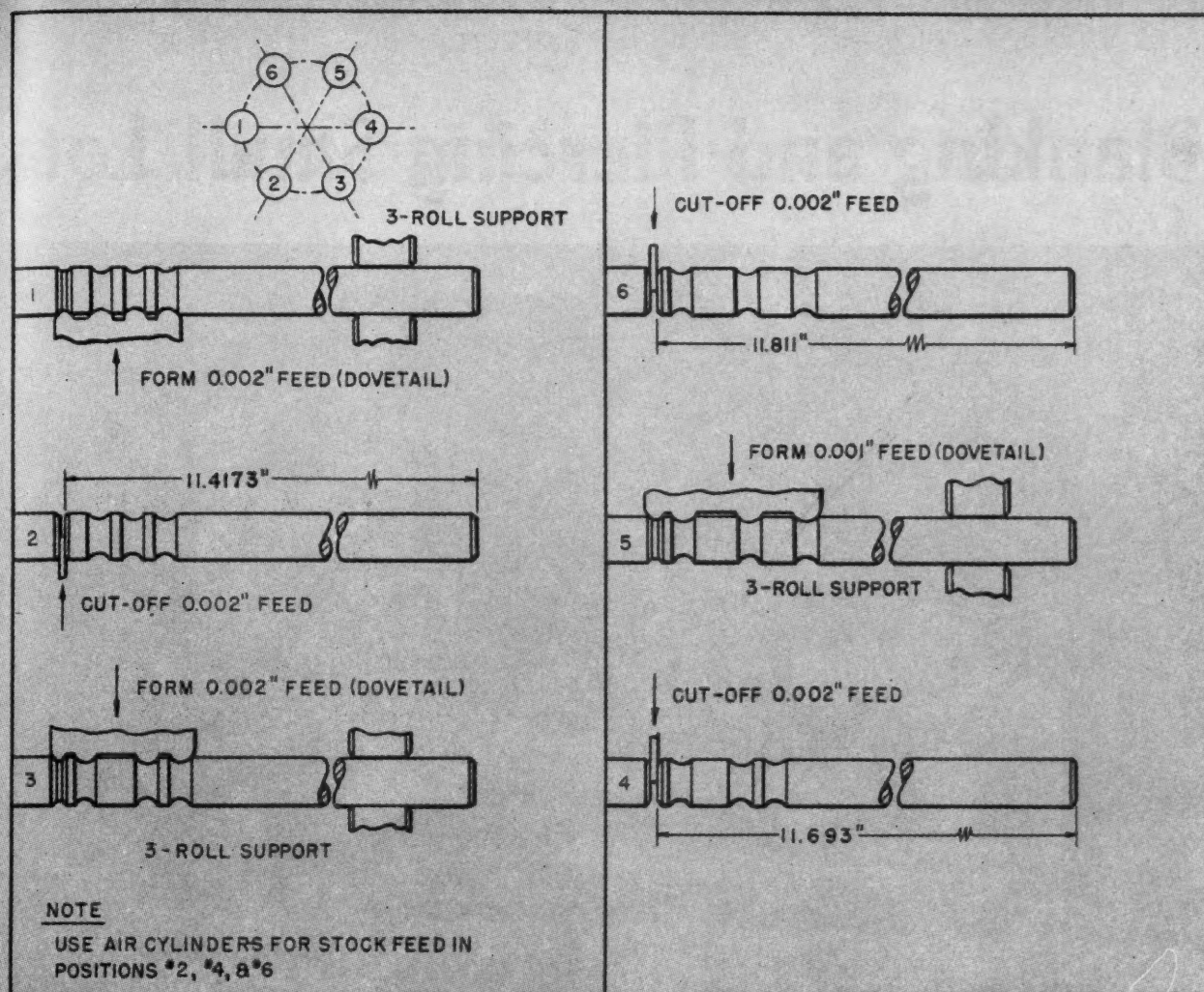
Besides utilizing the entire cycle of a multiple-spindle automatic bar machine for making parts of more or less complicated shape, these machines can also be used to produce several different relatively simple parts at one time. Fig. 8 shows a tooling lay-out used in manufacturing shifting rods for a foreign motor car. Here it can be seen that three rods of different lengths and forms are made for every complete cycle of a 1 1/4-inch six-spindle Conomatic. One rod of each kind is made every twenty-nine seconds, resulting in a production rate of 124 of each kind

per hour or a total of 372 pieces per hour. These parts were machined from S A E 1045 steel bar stock, 0.769 inch in diameter, by high-speed steel tools, using a feed of 97 surface feet per minute. In the first, third, and fifth positions, the bars for the three different parts are machined by form tools. During these operations three-roll supports are used for the bar.

In the second, fourth, and sixth positions (see also Fig. 9), cut-off tools sever the formed rods from the bars. These tools are fed at the rate of 0.002 inch per revolution. Air cylinders

Fig. 7. Tooling lay-out for eight-spindle Conomatic employed to produce wrench handle shown in Fig. 6



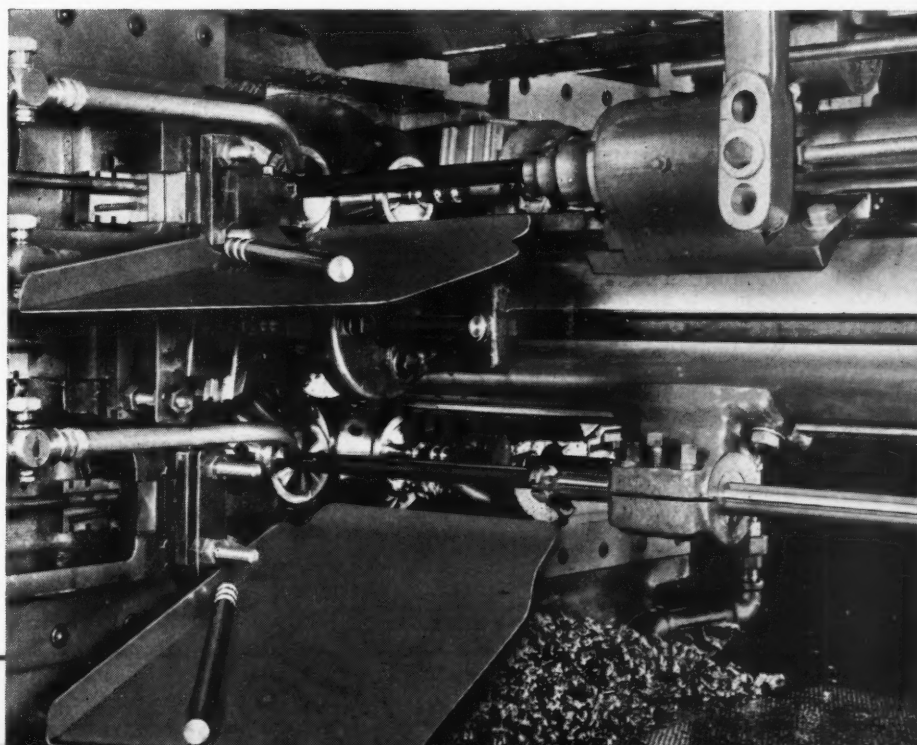


are used to feed the stock to the machine in these positions.

Although the examples described above are not unusual, it can be seen that multiple-spindle

automatic bar machines have a wide range of applications. By making full use of their facilities, many different parts can be produced economically and accurately in varying quantities.

Fig. 9. Three completely machined automobile shifting rods are cut off in the second, fourth, and sixth positions of the Conomatic illustrated



Blanking and Piercing Small Lots



VARIOUS types of blanking and piercing dies have been developed to reduce tooling costs for experimental and development work for the manufacture of products requiring limited output, or for cases where there is a question as to the design of the part or the commercial possibilities of the assembly in which the parts are to be used. Through years of experience in producing such tools, the Dayton Rogers Mfg. Co. has developed unique low-cost methods of blanking and piercing small quantities of parts quickly and accurately. With these methods, tools can be built for as little as 15 per cent of the cost of conventional permanent tooling. In general, the methods are most economical when the quantity of stampings required ranges from 100 to 5000.

The process is adaptable to the production of stampings from the smallest pierced and blanked piece up to an over-all size of 36 by 48 inches. Parts of practically any material or design up to 1/8 inch thick can be produced in this way with a minimum die cost. The maximum blanking pressure that should be employed with these tools is 300 tons. Average die life is from 9000 to 20,000 blanks.

As an example, assume that an annual production of 500 stampings such as illustrated in Fig. 1 is required. The over-all profile of the blank has a tolerance of ± 0.003 inch, all hole locations must be maintained within ± 0.0015 inch, and the tolerances on the hole sizes are as indicated on the drawing. The parts are to be produced from cold-rolled steel sheets 0.065 inch thick.

Blanking and piercing operations are performed separately, the blank being produced on a special cushion blanking punch and die shown in Fig. 2. The relative position of blanking die *A* and punch *B* is the reverse of that employed in conventional blanking operations. Punch *B* is fastened to the special sub-bolster plate *C*, while die *A* is merely nested over the punch. The die is retained in the correct horizontal position by four adjustable die stops *D*. These stops, provided on both sides of the strip stock and at both ends of the die, also serve to guide the die in its vertical travel during the stamping cycle.

A hardened and ground block *E* is provided on the press ram to transmit pressure to the blanking die during the down stroke of the ram. The sheet stock to be blanked is fed between the blanking die and stripper plate *F* until it comes

by Low-Cost Methods

By D. A. ROGERS, President
Dayton Rogers Mfg. Co.
Minneapolis, Minn.

in contact with the automatic stop *G*. The stripper plate also serves as a guide for the material being fed through the press.

As the ram descends, block *E* forces the die, strip stock, and stripper downward to the position shown at the right in Fig. 2, thus producing blank *H*. On the up stroke of the ram, the strip stock and blanking die are lifted from the punch by the action of die cushion *J* and pins *K* on stripper plate *F*. As the ram continues to rise, ejector rod *L*, actuated by an air cylinder below the press, holds blank *H* against the lower face of block *E* until the blank is raised above the die and can be blown from the working position. When the ejector rod is automatically retracted and the strip stock is fed to the left, stop *G* picks up the blanked opening in the scrap end of the stock, and the cycle is repeated. Such parts can be blanked at rates varying from 100 to 200 per minute.

A die of the type just described is shown mounted on a Bliss open-back inclinable press in Fig. 3. The pneumatic control mechanism permits blanking at maximum press speeds. Valve *M*, actuated by cam *N*, controls the operation of air cylinder *O*, which advances and retracts the ejector rod *L*, Fig. 2. A second cam *P* actuates air-flow valve *Q* which controls the blast of air

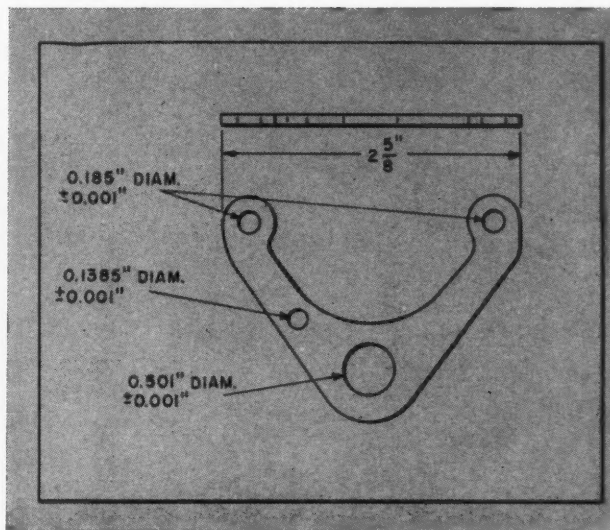
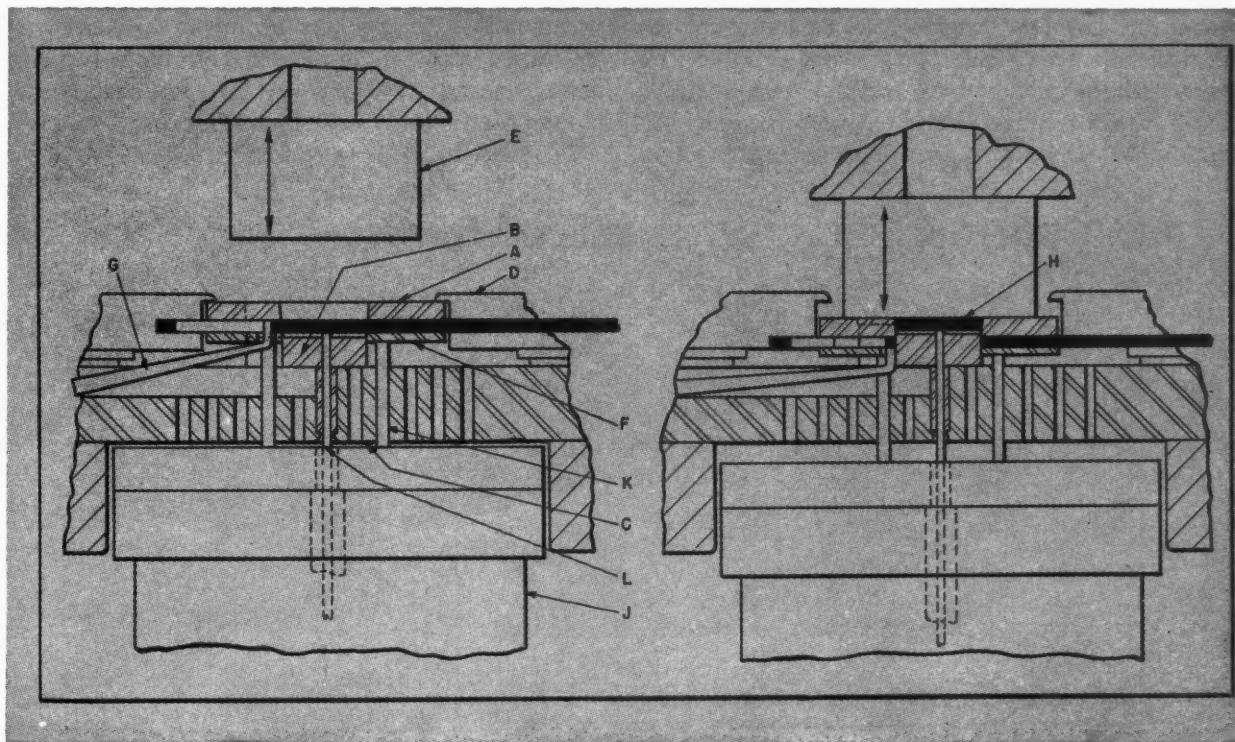


Fig. 1. Blank that is economically produced in small quantities on the special cushion blanking punch and die shown in Fig. 2

Fig. 2. Special die used to produce small lots of blanks economically. The relative position of blanking die (*A*) and punch (*B*) is opposite to that employed in ordinary dies



BLANKING AND PIERCING

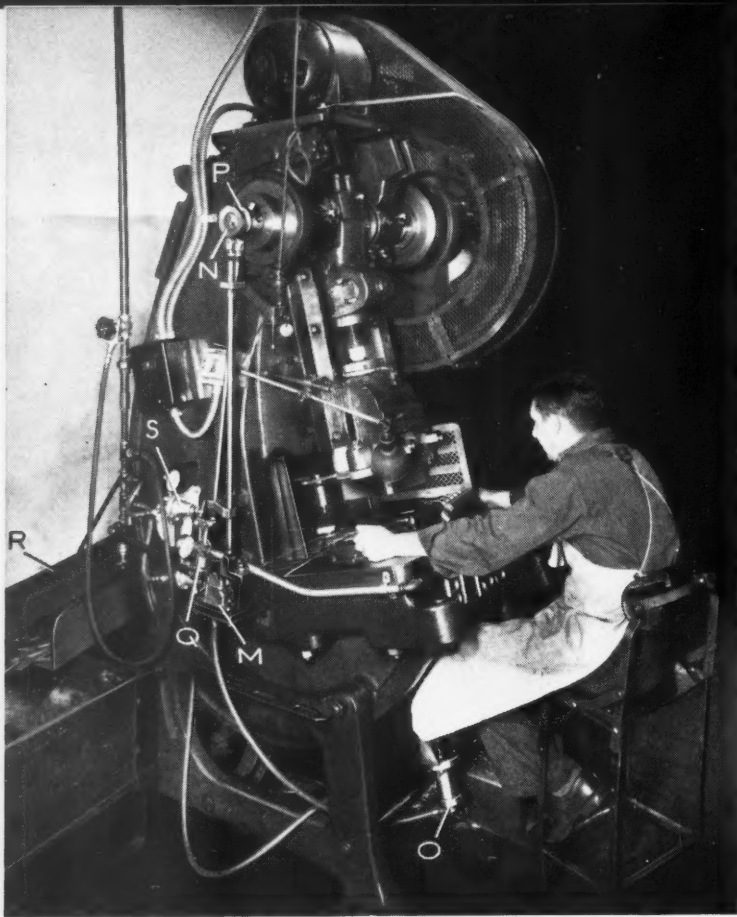


Fig. 3. A pneumatic control mechanism is provided on this standard open-back inclinable press to permit the rapid, low-cost production of small quantities of blanks

times as many as four ejector rods are required to remove large blanks from the die working position.

The piercing of holes accurately and economically in various sizes and shapes of blanks for short-run production is accomplished in the Dayton Rogers plant by means of specially designed, electrically controlled piercing presses, such as those seen in the heading illustration. These presses are provided with interchangeable round punches and dies ranging in diameter from 0.015 to 1.125 inches, and varying in size by increments of 0.001 inch.

A special fixture, Fig. 4, is provided for locating and holding the blank *A*. Four holes corresponding to the holes required to be pierced in the blank are jig-bored in the 3/16-inch thick plate *B* of the fixture. A piece of the strip stock scrap from the blanking operation is employed as the nest *C*. The nest is pinned to plate *B*, and serves as a means for locating blank *A* in the correct position on the piercing fixture.

When two or more holes of different sizes are to be pierced in a blank, the piercing fixture—with the blank in the nest—is passed through as many presses as there are different sized holes in the part. The special piercing presses are self-contained, and can be moved from place to place, power being provided by an extension cord plugged into any convenient outlet.

When several presses are required to pierce

that blows the blank into receiving chute *R*. Control valves *S* maintain a constant pressure of the air supplied to the pneumatic control equipment, compensating for changes in pressure of the shop line.

The same basic die design and construction is employed for blanking larger parts. It has been found that blanks measuring more than 12 by 12 inches do not lend themselves to being blown from the die area. Such blanks are produced on large straight-side presses, and the blank is lifted out of the die. Two or more die cushions are employed to control the stripper pins, and some-

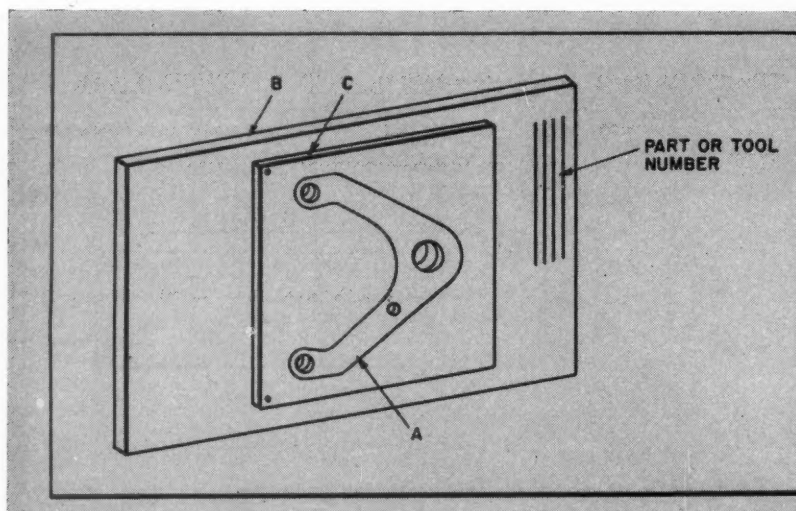


Fig. 4. Special piercing fixture, consisting of plate (B) and nest (C), for accurately locating blank (A) during the piercing operation

Fig. 5. Electrically controlled piercing presses arranged in a semicircle to facilitate piercing several different sized holes in the same blank



different sized holes in the same blank, the presses can be grouped in a semicircle, as shown in Fig. 5, so that a single operator can attend to them all. As the part shown in Fig. 1 contains four holes of three different sizes, three presses would be employed to complete the piercing operation.

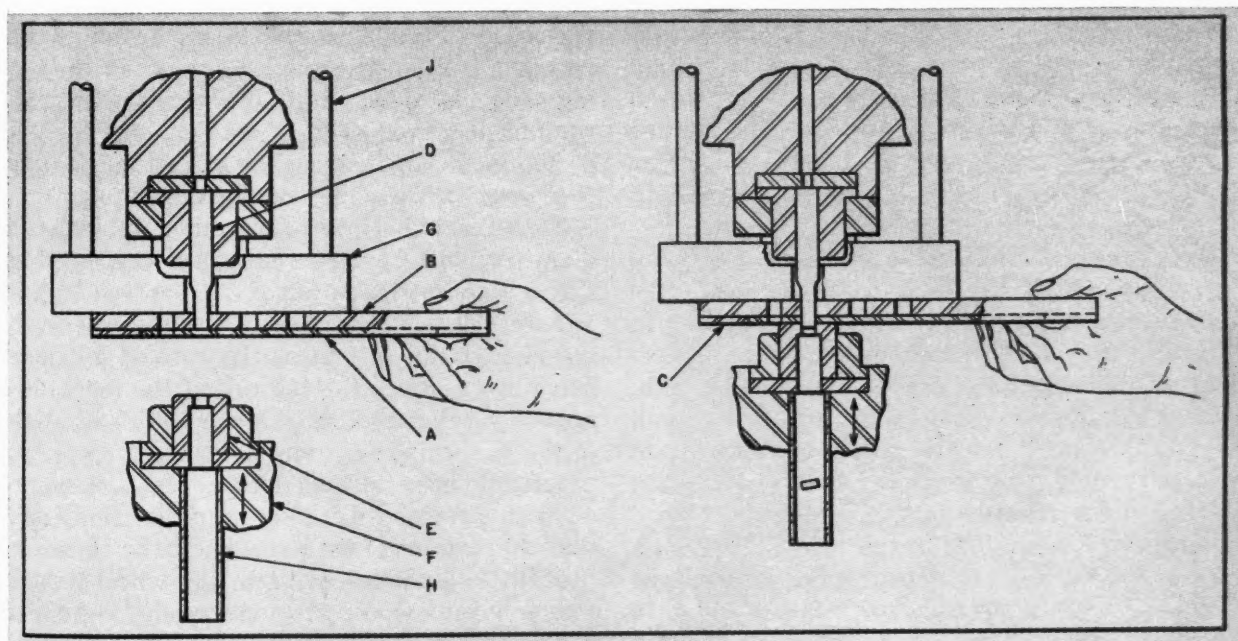
A typical set-up employed on a special piercing press of the type described is illustrated in Fig. 6. Unlike conventional piercing dies, punch *D* has no reciprocating motion, being held stationary

in the crown or arch section of the press. Piercing die *E* is carried on a reciprocating ram *F* at the bottom of the press, the ram operating through what would commonly be referred to as the bolster plate.

With blank *A* held in nest *C* of the piercing fixture, the fixture is positioned, as shown, the end of the punch being inserted in one of the holes in plate *B*. This automatically closes an electrical circuit and magnetizes stripper plate *G*,

(Concluded on page 177)

Fig. 6. Set-up employed on a special press for economically piercing small quantities of stampings. Punch (D) is stationary and piercing die (E) is carried on the reciprocating ram (F) at the bottom of the press



Versatile Tooling Used in



Outstanding Examples
of the Flexible Ma-
chines and Tooling
Used by the Austin-
Western Co. in the
Small-Lot Manufac-
ture of Various Sized
Parts for Road-Build-
ing Machines

By K. A. LONG
Chief Industrial Engineer
Austin-Western Co.
Aurora, Ill.

Fig. 1. By milling the top and both sides of cast-iron transmission housings simultaneously, parallelism and squareness are maintained within 0.0015 inch

ACCURATE parts, varying widely in size, are required for the manufacture of graders, sweepers, small shovels, and other road-building equipment. The use of single-purpose, high-production machine tools for making such parts in small lots, obviously, is not feasible. To produce these parts on an economical basis, versatile tooling has been developed by the Austin-Western Co., and flexible type machine tools are utilized capable of handling a variety of work.

Work-pieces from 8 to 40 inches wide and up to 24 inches high can be accurately milled on the Sundstrand triple-head milling machine seen in Fig. 1. The three spindle heads—one vertical and two horizontal—are equipped with individual motor drives, and can be adjusted to mill three sides of the work simultaneously or to operate independently. Both sides and the top surface of a transmission housing for a road grader are being milled in the set-up illustrated.

About 1/4 to 7/16 inch of stock is removed from each side of the cast-iron housing and 5/16 inch from the top surface in two cuts. The top

is rough- and finish-milled and the sides are rough- and semi-finish-milled in the same set-up. Approximately 0.020 inch of stock is left on each side to be removed in a subsequent finishing operation. Parallelism of the sides and squareness of the sides with the top surface of the casting are maintained within 0.0015 inch. With this equipment a production of six housings per hour is obtained—an increase of more than 200 per cent over previous methods of machining.

Three carbide-tipped face mills, 14 inches in diameter, with fourteen teeth, are employed for this job. A cutting speed of 326 surface feet per minute (89 R.P.M.) is used, and the work-table is fed past the cutters at the rate of 10 inches per minute. Since the top rail of the machine is always parallel with the table and at right angles to the side rails, accuracy is insured. There are practically no rejections in this operation, whereas with previous methods of production, more than 50 per cent of the parts had to be reworked.

Multiple-diameter bores in the wheel hub for road graders are rough-, semi-finish-, and finish-bored and the hub is turned, faced, and cham-

Building Road Machinery

ferred in one automatic operation on the Bullard 30-inch "Man-Au-Trol" vertical turret lathe shown in Fig. 2. By machining the opposed bores, face, and periphery of the malleable iron part in one set-up, without having to reverse the part in the chuck or transfer it to another machine, concentricity and squareness can be held to close tolerances. Accurate alignment is insured when anti-friction bearings are subsequently assembled in the opposed bores of the hub. Bore sizes are maintained within 0.001 inch, and concentricity is held to ± 0.0005 inch. Floor to floor time per wheel hub has been reduced from nearly two hours to one-half hour by means of this set-up. Previously three set-ups were required.

Both the main turret-head and the side-head on the machine are equipped with a four-face automatic indexing turret and a "Man-Au-Trol" combination electric and hydraulic control system. Each control system is preset to perform automatically thirty-nine separate functions in the desired sequence. Variables that can be preset on each head are direction of feed and power traverse (up, down, in, or out), indexing of turret, spindle speeds, and rates of feed. The machine can be operated manually at any time or at any point in the automatic cycle by moving a single lever.

The cast wheel hub is held by its flange in a three-jaw chuck on the rotary table of the vertical turret lathe. Only those surfaces of the hub that contact the chuck jaws have to be machined in subsequent operations. From 3/16 to 5/16 inch of stock is removed from the various surfaces of the part. Power traverse rates of 0.031, 0.062, 0.083, and 0.125 inch per revolution are employed to bring the tools to the required positions during the automatic cycle. The tool feed for rough-boring is 0.020 inch per revolution and the work speed 70 R.P.M. For facing, chamfering, turning, and finish-boring, the work speed is increased to 125 R.P.M. and the tool feed is reduced to 0.015 inch per revolution.

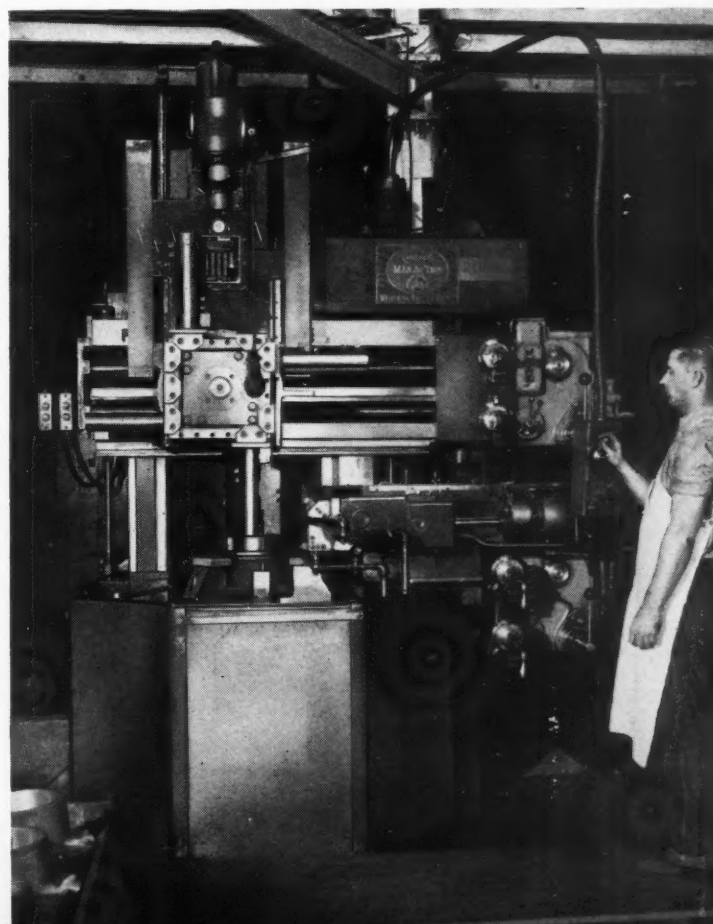
The flanged ends of axle trunnion sockets are bored, counterbored, turned, faced, back-faced, and chamfered on the Potter & Johnston automatic illustrated in Fig. 3. The trunnion

sockets, forged from S A E 4140 steel, are heat-treated prior to machining to obtain a Brinell hardness of 285 to 321. Special formed adapters are provided on the three-jaw chuck to grip the socket on its forged spherical surface. The work is rotated at 97 R.P.M., and the tools are fed at 0.010 inch per revolution.

The first turret face and cross-slide carry tools for rough-facing the flange, rough-counterboring, and rough-turning the periphery and hub of the flange. Upon the completion of these operations, the turret is indexed in a counter-clockwise direction to bring the tools on the second turret face into the working position. These tools are employed to finish-turn the periphery of the flange (8 3/8 inches in diameter), semi-finish-turn the flange hub (3 3/4 inches in diameter), semi-finish-counterbore (3.370 inches in diameter), and semi-finish-bore (2 3/4 inches in diameter). Both sides of the flange are finish-faced at this station by tools mounted on the cross-slide.

The hub on the flanged end of the trunnion socket is faced and chamfered at the next station. Tools on the turret finish-turn the outside diameter of the hub, chamfer the flange periphery, and finish-counterbore. Both the hub periphery and counterbore are maintained within ± 0.0015 inch of the desired size. A surface finish of from

Fig. 2. Time required for boring, turning, chamfering, and facing wheel hubs has been reduced from nearly two hours to one-half hour by means of the semi-automatic set-up illustrated



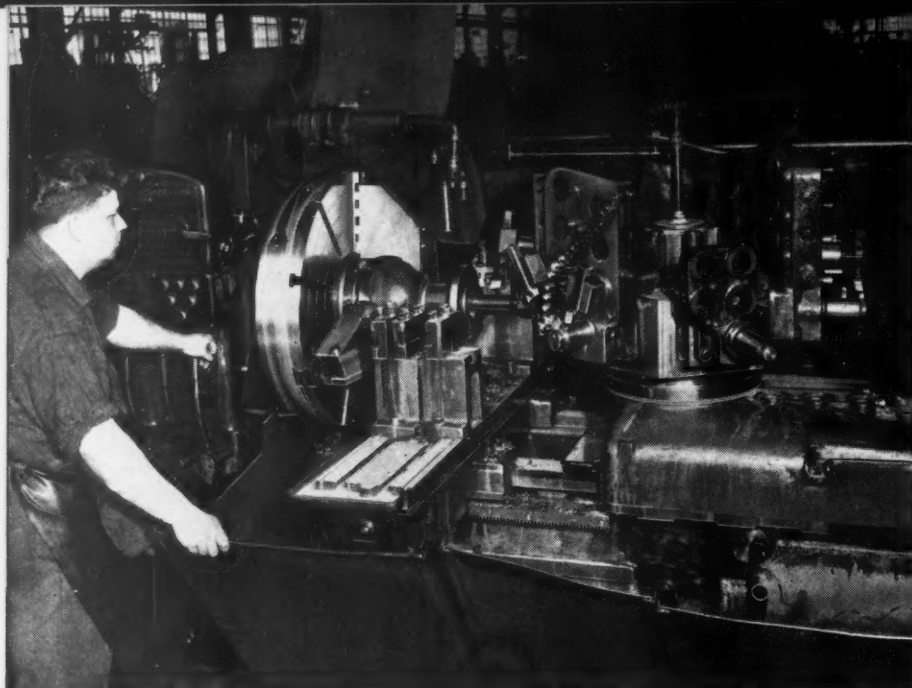


Fig. 3. Smooth surface finishes and close tolerances are attained in machining the flanged ends of axle trunnion sockets for steering-knuckle assemblies

49 to 59 micro-inches r.m.s. is maintained on the counterbore, and from 67 to 87 micro-inches on the hub periphery and outside face of the flange.

With the part chucked on the finish-machined flanged end in a second Potter & Johnston automatic, Fig. 4, the spherical surface of the forging is rough- and finish-turned in one set-up. The finish on the spherical surface must be as smooth as possible to minimize wear of the felt seal with which it is in contact after assembly. About $3/32$ inch of stock is removed in the rough-turning operation, leaving 0.020 inch of stock for removal in the finishing cut. A tolerance of ± 0.005 inch is maintained on the spherical surface, which has a radius of 5.370 inches.

Both roughing and finishing tools, which are of the single-point, carbide-tipped type, are mounted in a holder seen directly above the spherical surface on the trunnion socket. The holder is bolted to an integral arm and shaft,

which is carried in a pedestal on the rear of the tool-slide. A pinion mounted on the shaft meshes with a rack on the turret of the lathe. When the turret is advanced toward the work, the tools are pivoted about the center line of the spherical surface, which coincides with the center line of the shaft.

In the same set-up, the spherical end of the trunnion socket is bored to a diameter of 8 inches and a counterbore ($4\ 3/8$ inches diameter) is faced. The work is rotated at 128 R.P.M., and the tools are fed at 0.007 inch per revolution.

Transverse holes are drilled, bored, and counterbored in both sides of the trunnion socket on a double-end boring machine, Fig. 5, made by the Barnes Drill Co. The two drills, $2\ 7/8$ inches in diameter, cut through the $1\ 1/4$ -inch thick forged walls of the spherical socket. Both bored and counterbored holes are held to a tolerance of ± 0.0015 inch and a surface finish of from 67 to

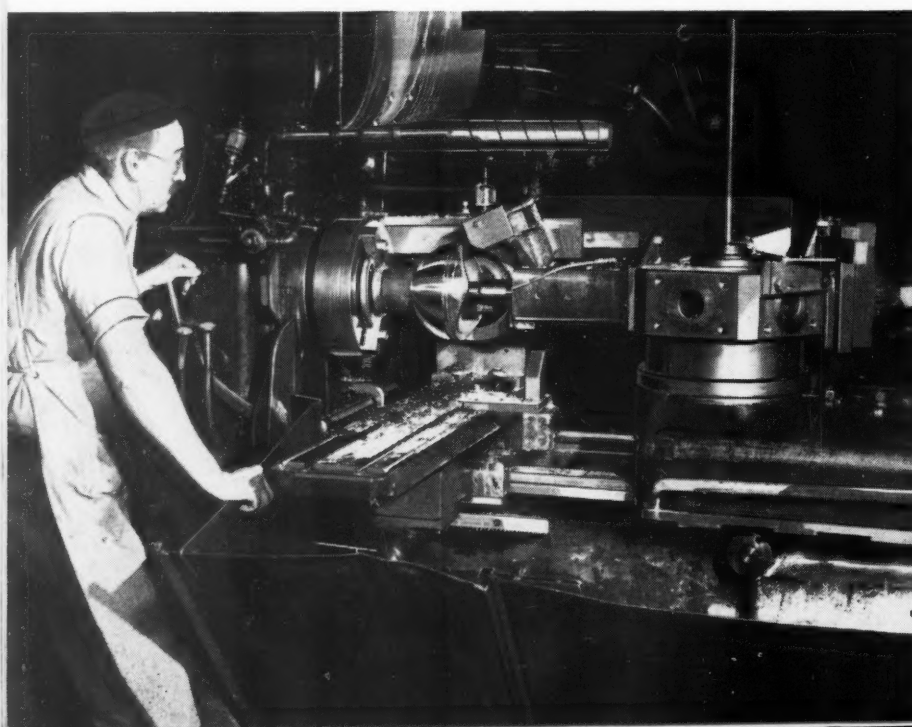


Fig. 4. Set-up employed to rough- and finish-turn the spherical surface on forged trunnion sockets. The work is bored and faced in the same set-up

Fig. 5. A double-end boring machine is used to drill, bore, and counterbore holes, 2 7/8 inches in diameter, in the spherical ends of trunnion sockets



87 micro-inches r.m.s. The bores, which serve as anti-friction bearing seats, must be opposite and parallel within 0.003 inch. On this machine, four trunnion sockets are completed per hour, compared with the previous production of 2 1/2 per hour obtained from two machines.

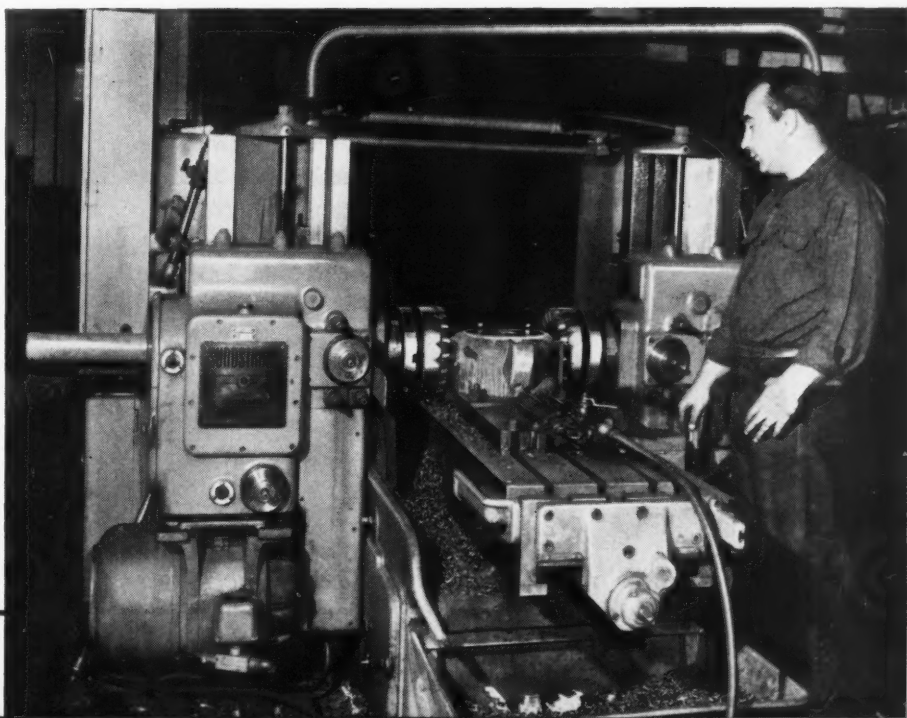
A quick-acting air-operated fixture is employed to locate and clamp the work. The high-speed steel drills are operated at a speed of 49 R.P.M., with a feed of 5 1/2 inches per minute. Following this operation, the drills are replaced by boring-bars, which progressively rough bore and counterbore, and finish bore and counterbore. In this case, the speed is 134 R.P.M., and the feed 4 1/2 inches per minute. Tools are pre-set in the boring-bars during sharpening, and thus are ready to be placed in the machine without re-setting when required.

Rear flanges for the steering knuckles of road grading machines are straddle-milled on the

Sundstrand duplex milling machine illustrated in Fig. 6. For this operation, the malleable-iron casting is located and clamped on the milling machine table by means of an air-operated cam fixture. A rack on the ram of the air cylinder meshes with a pinion on the camshaft of the fixture. The cam grooves actuate pins in the fixture, which engage previously bored holes in the cast flange, thus accurately locating and securely clamping the work during the milling operation. A regulator is employed to control the air pressure, so that the fragile casting will not be distorted during machining.

Carbide-tipped face mills, 8 inches in diameter, are used for this operation. The cutters are rotated at 143 R.P.M., and the work is fed past them at the rate of 7 1/2 inches per minute. Stock removal averages about 3/16 inch from each face. The over-all width of the finished part (13.124 inches) and the parallelism of the milled

Fig. 6. An air-operated cam fixture is employed to accurately locate and securely clamp cast rear flanges for steering knuckles in a straddle milling operation



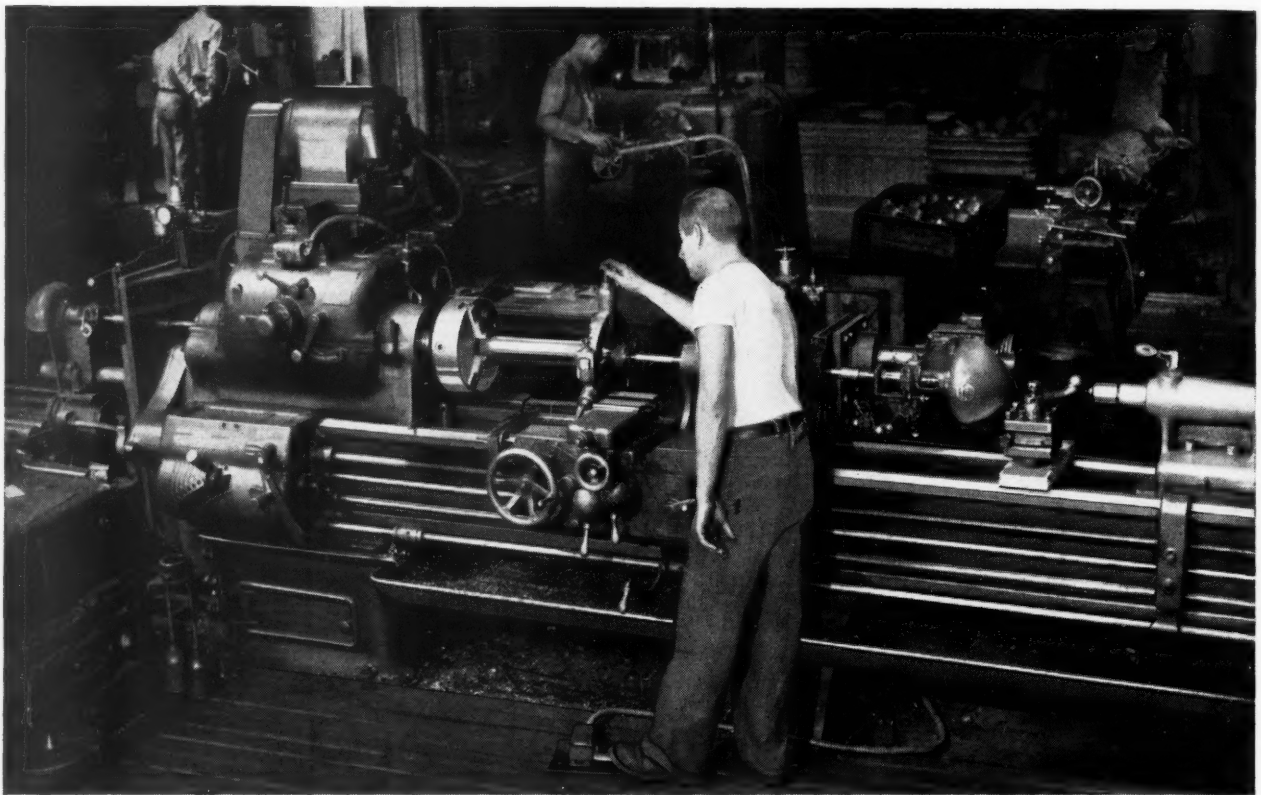


Fig. 7. Simple method of converting a lathe into a double-end shaft-centering machine. Two drill heads are employed, one mounted on the headstock and the other on a modified tailstock casting

flanges are held to a tolerance of 0.001 inch. A surface finish of about 54 micro-inches r.m.s. is obtained on these surfaces.

A unique arrangement by means of which a lathe is converted to a double-end shaft-centering machine is illustrated in Fig. 7. Two Delta drilling heads are mounted on a Springfield lathe, one at the headstock end and the other on a modified tailstock casting. The long drilling spindle on one head extends through the hollow spindle of the lathe headstock, while the spindle on the other head passes through the tailstock casting. Bellows automatic, air-operated feed units are provided on each drilling head to accurately control the depth of center drilled.

After sawing the shaft to length, plus 1/16 inch, it is abutted against a stop fastened to the three-jaw chuck of the lathe. The steadyrest is then applied to the opposite end of the shaft and both ends of the shaft are center-drilled simultaneously and one end is faced to over-all length. A tolerance of ± 0.0015 inch is maintained on the center depths.

By means of this set-up, the time required for centering each shaft and facing to length has been reduced from 15 to 3 1/2 minutes. Also, transporting the shafts between the two machines formerly required has been eliminated, closer tolerances are maintained on the center depths, reworking of the shafts has been minimized, and substantial savings have been effected through the use of smaller diameter stock. In cases where the lathe is not required full time for centering purposes, it can be reconverted for conventional operation by simply replacing the tailstock.

This set-up is especially suitable for centering multi-diameter shafts where the largest diameter of the finished shaft is to be near one end. By placing the steadyrest near this end, the rotating shaft is centered in the area in which the maximum diameter will be produced, thereby permitting the use of stock of minimum diameter. For example, shafts on which a 2 27/32-inch diameter is turned are produced from 2 7/8-inch diameter hot-rolled bar stock.

The Mid-Century Year Looks Promising

PROSPECTS for greater sales of machine tools and other metal-working equipment in the coming year appear most promising. Practically all business prognosticators predict an up turn in general conditions for at least the first half of the year, and equipment manufacturers are expected to share in the rise. The year 1950 should show a definite improvement over 1949 in the equipment field.

The most gratifying indications for better business in the metal-working industries come from a national survey recently sponsored by the American Society of Tool Engineers. Eighty per cent of the companies included in this survey signified that they would buy either more equipment than they did in 1948 or at least the same amount. The year 1948 was substantially better than 1949. Only 13 per cent of the companies reported that they intended to buy very little new equipment.

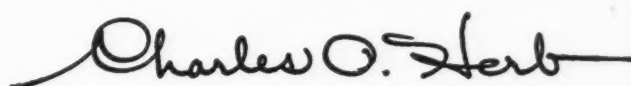
Sixty-four per cent of the companies plan to purchase new machines primarily to reduce manufacturing costs, and 27 per cent will make substantial investments in materials-handling equipment. Twelve per cent reported that their largest financial outlay would be for the replacement of worn-out and obsolete equipment.

Only 7 per cent indicated that their investment in new equipment would be less than in 1948.

Not only is it important for machinery manufacturers to know that their business should be considerably better next year, but they should also know the percentage of business that may be anticipated from various sections of the country. It is for this reason that MACHINERY's Research Department made a study of the geographical distribution of machine tool sales in 1948. The results of this study are given on the next two pages of this issue.

During the last decade, such factors as the decentralization of manufacturing plants, the expansion of manufacturing facilities in existing plants, and the establishment of new plants for new industries have accounted for geographical shifts in metal-working activity, and consequently in the buying power for the machines, tools, and work-handling equipment purchased by metal-working plants.

The survey shows how this buying power lines up currently—buying power not only for machine tools, but also for the various types of small tools and cutters, machine accessories, motors, lubricants, raw materials, etc., that are required wherever machine tools are used.


EDITOR

Where Machine Tools are Sold

MACHINE tools are the backbone of the metal-working industries, and it is obvious that the sections of the

United States in which the most machine tools are sold also comprise the most important metal-working areas. Everyone concerned with selling to metal-working plants will, therefore, be interested in the results of a survey made by MACHINERY's Research Department to determine how 1948 sales of machine tools were distributed geographically within the United States.

The table below shows the relative standings of the states as purchasers of machine tools. On the map facing this page, the shaded areas show the locations of the fourteen states that each accounted for more than 1 per cent of all machine tool sales reported. The key numbers on these states refer to the bars in the chart immediately below the map, and the key letters refer to the

A Study Made by MACHINERY of the Geographical Distribution of 1948 Machine Tool Sales

state groups shown in the other chart.

The upper chart shows the relative rank of the fourteen most important machine tool pur-

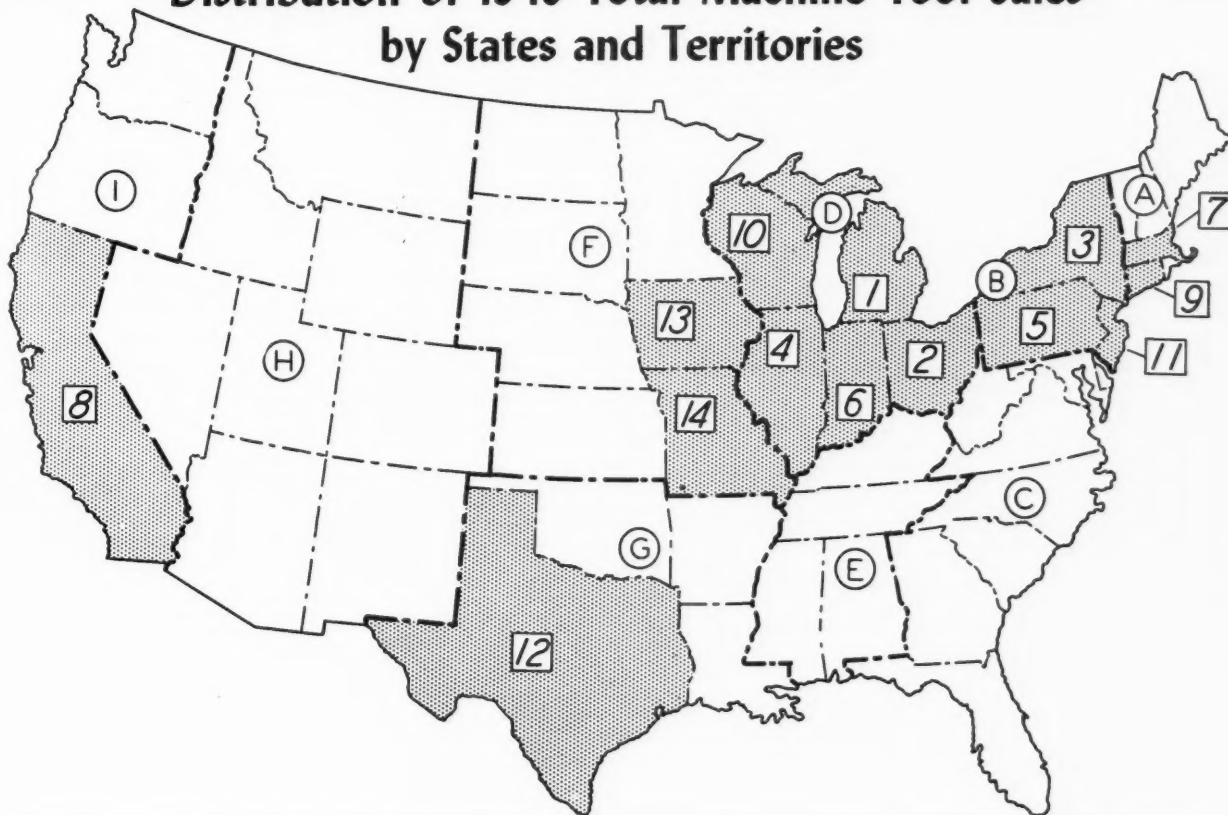
chasing states. As in previous years, Michigan ranked first by a fairly wide margin, followed by Ohio, New York, Illinois, and Pennsylvania. Together, these five states accounted for 56.29 per cent of all 1948 machine tool sales, compared with 54.33 per cent in 1947. Machine tool sales in all the states charted amounted to 88.46 per cent in 1948, as against 86.65 per cent in 1947.

To obtain the necessary data, 354 manufacturers of all types of machine tools were asked for a percentage breakdown of their 1948 domestic machine tool sales based on dollar volume, by either states or territories. A total of 138 breakdowns was received, or 39 per cent. Of these, 130 were state breakdowns, and the final compilation was therefore made on a state basis.

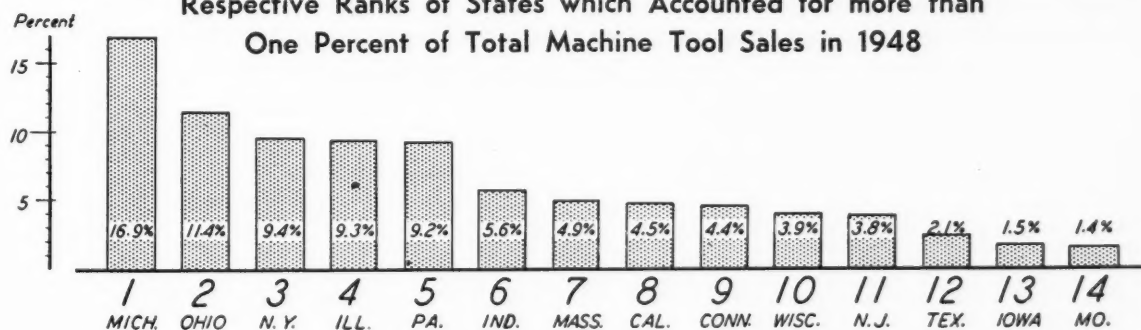
Distribution of 1948 Machine Tool Sales

State and State Group	Per Cent	State and State Group	Per Cent
Maine	0.27	Minnesota	0.97
New Hampshire	0.18	Iowa	1.52
Vermont	0.25	Missouri	1.45
Massachusetts	4.88	North Dakota	0.01
Rhode Island	0.90	South Dakota	0.01
Connecticut	4.44	Nebraska	0.39
New England	10.92	Kansas	0.37
New York	9.38	West North Central	4.72
New Jersey	3.82	Arkansas	0.12
Pennsylvania	9.25	Louisiana	0.34
Middle Atlantic	22.45	Oklahoma	0.52
Delaware	0.13	Texas	2.07
Maryland	0.63	West South Central	3.05
District of Columbia	0.25	Montana	0.06
Virginia	0.91	Idaho	0.04
West Virginia	0.43	Wyoming	0.01
North Carolina	0.63	Colorado	0.18
South Carolina	0.22	New Mexico	0.12
Georgia	0.37	Arizona	0.09
Florida	0.28	Utah	0.18
South Atlantic	3.85	Nevada	0.03
Ohio	11.38	Mountain	0.71
Indiana	5.60	Washington	0.58
Illinois	9.33	Oregon	0.23
Michigan	16.95	California	4.49
Wisconsin	3.85	Pacific	5.30
East North Central	47.15	Total United States	100.00
Kentucky	0.65		
Tennessee	0.67		
Alabama	0.47		
Mississippi	0.06		
East South Central	1.85		

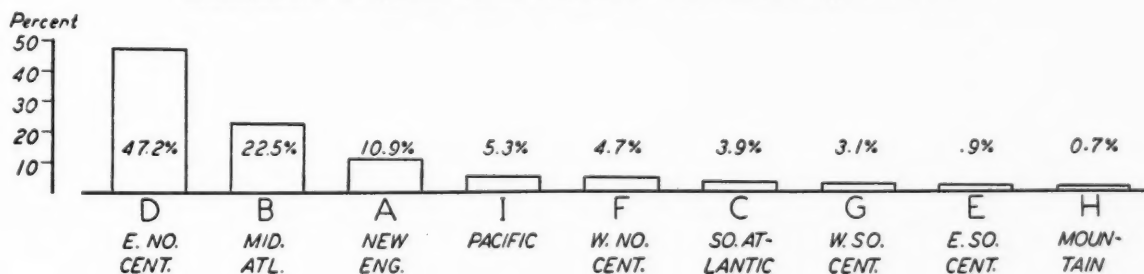
Distribution of 1948 Total Machine Tool Sales by States and Territories



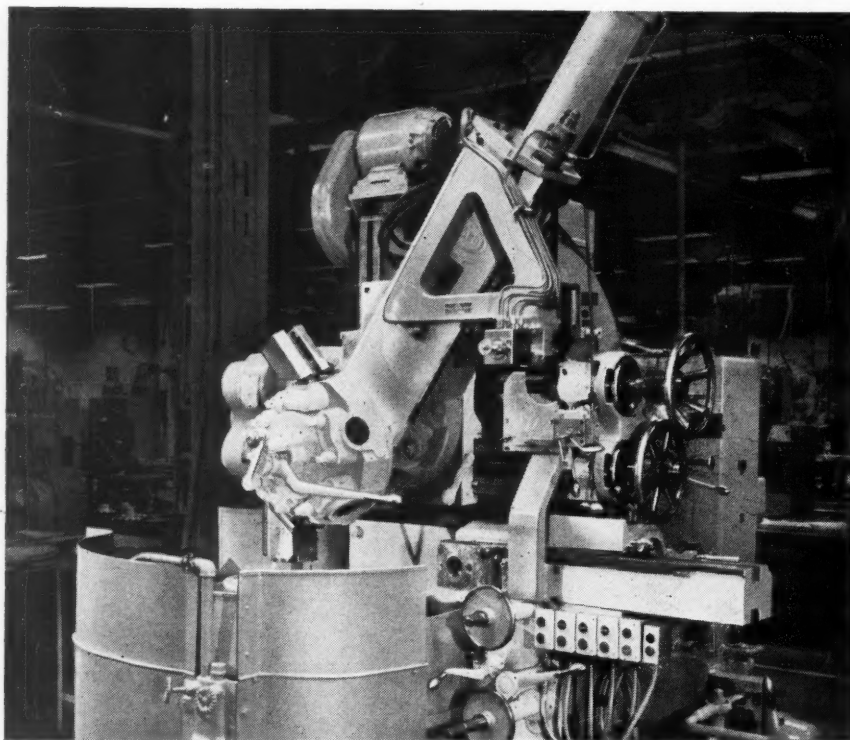
Respective Ranks of States which Accounted for more than
One Percent of Total Machine Tool Sales in 1948



Breakdown of 1948 Total Machine Tool Sales by Territories



Automatic Tracer-Duplicator Vertical



Production Demands in the Duplicating of Machined Shapes Often Require Automatic Control of Cutting Tools. A Hydraulic Device Used for This Purpose on Vertical Lathes is Described Here

FOR machining parts having odd shapes or forms at Allison Division, General Motors Corporation, Indianapolis, Ind., automatic tracer-duplicators have been installed on several Bullard vertical turret lathes. One of these machines equipped with a Turchan automatic hydraulic duplicating attachment is shown in Figs. 1 and 2 set up for taking a cut with a carbide tool on the entire inside contour of a forged steel converter housing for a tank transmission.

The duplicating attachment, or follower, controls the movement of the cross-slide and vertical slide of the lathe by hydraulic cylinders which are supplied with oil in varying amounts through a tracer valve. Oil flow from the valve is controlled by a tracer in contact with templet A which has the same contour as that to be reproduced in the work.

As the tool is held at an angle to the vertical center line of the lathe, two dimensions can be

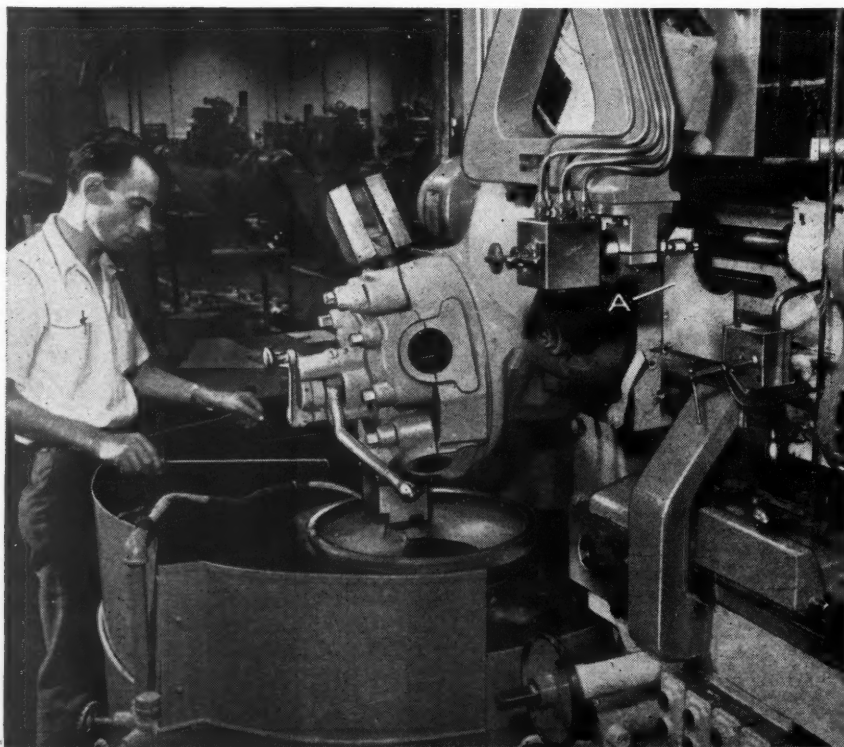


Fig. 1. (Above) Bullard vertical turret lathe equipped with an automatic hydraulic follower for duplicating machined shapes and forms in accordance with the contour on a templet

Fig. 2. (Left) A valve with a tracer in contact with templet (A) controls the flow of oil to hydraulic cylinders that actuate the tool-slide at an angle

Controls Contour Machining on Lathes

machined by a single control. Boring, facing, and outside diameter turning of work with flanges, steps, tapers, shoulders, radii, and thread run-out grooves can be accomplished automatically with uninterrupted cuts over large surfaces.

Form tools are eliminated by the employment of this device, since the templet controls the contour to be produced. Inasmuch as the pressure applied by the tracer to the templet is very light, templets can be made of thin stock, thus facilitating their construction. Changing of the templet is all that is required when it is necessary to set up the unit for a new job.

Another Turchan follower is shown in Fig. 3 applied to a 36-inch Bullard vertical turret lathe. In the operation illustrated, the inside contour of a magnesium-alloy compressor casing for a turbo-jet engine is being machined. Approximately 1/8 inch of material is to be removed, using a carbide-tipped cutting tool at a speed of 117 R.P.M. and a feed of 0.006 inch per revolution. Since the application of the cutting edge of the tool is constantly changing, a special round-nosed tool is employed. A subsequent finishing operation, performed on a similar machine, removes 1/32 inch of material.

There are numerous advantages to be gained by the use of these duplicating attachments, one of the principal advantages being the automatic accuracy of form obtained without constant checking of dimensions by the machine operator. In controlling the movement of the cross-slides and vertical slides of the machines illustrated, the duplicating attachment holds the tool movement in relation to the templet within a tolerance of 0.001 inch.

Other advantages include a minimum amount of set-up time, since the proper relationship between the tool and the tracer is the principal requirement. Once this is obtained and the first

diameter is machined and checked, all other shapes and sizes are produced entirely by tracer control over the tool, reducing the operator's duties to shutting off the feed at the end of the operation.

* * *

Quality Control Slide-Rule

A new slide-rule developed especially for the use of quality control engineers is being made by Pickett & Eckel, Inc., 5 S. Wabash Ave., Chicago 3, Ill. In addition to the ordinary log-log scale arrangement, this slide-rule is provided with quality control scales to aid in making the following calculations: Control limits for charts for measurements; comparison of process limits with specification limits; control limits for chart for per cent defective; and ordinates and areas for the normal curve of error.

It is claimed that most of the problems arising in quality control can be solved by means of this rule. As it includes the constants needed and the values for the normal curve, the time required for referring to tables in order to obtain these values is saved.

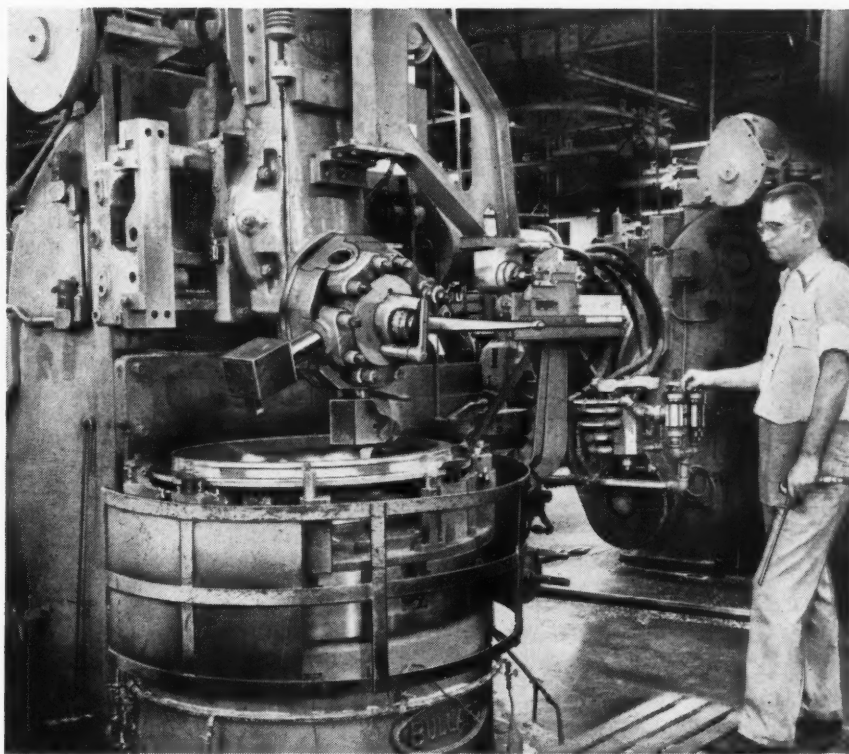


Fig. 3. Machining the inside contour of a magnesium-alloy compressor casing for a turbo-jet engine on a vertical turret lathe equipped with a hydraulic follower

Technical Contributions Toward Peace Discussed at A.S.M.E. Convention

APPROXIMATELY six thousand engineers from all parts of the country attended the annual convention of the American Society of Mechanical Engineers, held at the Hotel Statler in New York City, November 28 to December 2. Speakers from universities, laboratories, and every branch of industry delivered over two hundred papers at the seventy-eight technical sessions covering the fields of power, aviation, applied mechanics, fuels, gas turbines, heat transfer, machine design, hydraulics, etc.

Prominent figures in engineering, industry, and public life contributed to the success of the convention, which had as its theme "the application of technology to further a peaceful world." This keynote was sounded by Under Secretary of the Navy Kimball in discussing "The Complexities of Peace" at a luncheon sponsored by the American Rocket Society, an affiliate of the A.S.M.E. The theme was further developed by Assistant Secretary of the Air Force, Cornelius Vanderbilt Whitney who spoke on "Possible Contributions of Engineers to World Peace."

James M. Todd, outgoing president of the Society, delivered the presidential address at the annual dinner December 1, when the Society's awards were presented. Warning that history is full of the failures of nations to keep the peace by force, Mr. Todd asked American engineers to give the rest of the world the necessary inspiration to struggle toward a higher level of civilization. He was preceded on the speaker's rostrum by Dr. H. J. Gough, president of the Institution of Mechanical Engineers of Great Britain, whose topic was "May We Cooperate?"

Tell Berna, general manager of the National Machine Tool Builders' Association, in his address, pointed out that the tardiness of American industry in replacing obsolete machine tools with



James Dalton Cunningham, who took office as president of the American Society of Mechanical Engineers for 1950 at the recent annual convention

new models of greater productivity is slowing down the normal advancement in the American standard of living.

Mr. Berna stated that the wage-earner, the stockholder, and the user of the product benefit from the increased productivity of advances in machine design only if and when these new machines are put to work in the shop. The purchase of a new machine is a capital investment in the future. Referring to tax policies that have penalized such investments, Mr. Berna expressed the idea that the public should look to technological advances instead of to Government for a more abundant way of life.

Among the many prominent speakers at the convention were Louis Arthur Johnson, Secretary of Defense; the Honorable Arthur T. Vanderbilt, Chief Justice of the Supreme Court of New Jersey; Dr. Allan R. Cullimore, President Emeritus, Newark College of Engineering; and Dr. Lillian M. Gilbreth, President, Gilbreth, Inc., Montclair, N. J.

A number of papers of particular interest to the machine tool industry were presented. Among these was one on "A Study of Cutting Face Finishes and Treatments on Twist Drills," by C. E. Bierwirth, Master Mechanics Division, Buick Motor Division of General Motors Corporation. This paper described performance results obtained with different finishes and treatments on the faces of twist drills. The purpose of this study was to obtain information from actual production tests of tungsten- and molybdenum-steel drills, in order to analyze the performance and reconditioning requirements of these drills when used on cast iron and forged steel.

Several interesting papers on anti-friction bearings were read at a technical session presented under the auspices of the Machine Design Division, with John Haydock, Editor of *Design*

News, presiding as chairman. One of these papers was "Selection of Anti-Friction Bearings for Machine Tools," by John H. Baninger, assistant chief engineer, New Departure Division, General Motors Corporation, Bristol, Conn. Mr. Baninger discussed the three principal types of anti-friction bearings (radial- and angular-contact ball bearings, straight roller bearings, and tapered roller bearings), including their application and installation. An abstract of this paper appears on page 181 of this issue of *MACHINERY*.

Another paper entitled "Housings and Spindles for Anti-Friction Bearings," was presented at this session by H. L. Blood, an engineer of the Heald Machine Co., Worcester, Mass. Mr. Blood pointed out some of the important but less well-known points to be considered in the application of anti-friction bearings. It was stated, for example, that when deflection and vibration are important considerations, the spring rates or stress-strain curves of the bearings should be known in order to decide on the best location for the bearings. This information is not generally given in the catalogues supplied by bearing manufacturers. Shaft and housing tolerances for both ball and roller bearings were discussed, as was also preloading and the deflection of spindles and bearings.

A. S. Muessen, an engineer with the Western Electric Co., Inc., Kearny, N. J., contributed a paper entitled "The Manufacture of Mounting Apparatus Used in Communications Equipment" at a technical session presented by the Production Engineering Division. N. L. Bean, director of production engineering, Ford Motor Co., Highland Park, Mich., presided as chairman at this session. In his paper, Mr. Muessen described four principal types of mounting plates employed to support telephone equipment, and discussed the various methods used in producing them. Several unique applications of presses and punch and die assemblies were described in this paper.

Other outstanding papers included "Maintenance of Anti-Friction Bearings," by J. M. Bruening, president of the Ohio Ball Bearing Co., Cleveland, Ohio; "The Solution of a Materials-Handling Problem in a Metal-Working Plant," by C. H. Delamater, works manager, Aluminum Co. of America, Bridgeport, Conn.; "Isotopes as Tools of Engineering," by Paul C. Aebersold, chief of Isotopes Division, Oak Ridge Operations, U. S. Atomic Energy Commission, Oak Ridge, Tenn.; "Graphical Gear Train Design," by Lawrence G. F. Jones, engineer with Eckert-Mauchly Computer Corporation, Philadelphia, Pa.; and "Some Basic Studies in Proportional Control," by C. E. Mason, technical director, Bristol Co., Waterbury, Conn., and Victor

Paschkis, Heat and Mass Flow Analyzer Laboratory, Columbia University, New York.

At the annual dinner, previously mentioned, James Dalton Cunningham, president of Republic Flow Meters Co., Chicago, Ill., was introduced as national president of the American Society of Mechanical Engineers for 1950. Mr. Cunningham has previously held office as a manager and regional vice-president of the Society, and has served on many important committees. He became a Fellow of the Society in 1936.

* * *

"Multi-Slide" is a Registered Trademark

The name "Multi-Slide" mentioned in the article "Designing Tools for 'Multi-Slide' Machines" on pages 145 to 151 of May, 1949, *MACHINERY*, should have been capitalized and enclosed in quotation marks to indicate that the name "Multi-Slide" is a registered trademark. This is to correct any inference that the name "Multi-Slide" was used in a generic sense.

* * *

Warner & Swasey Wins Freedom Foundation Award

The Warner & Swasey Co., Cleveland, Ohio, manufacturer of turret lathes and textile machinery, has received the 1949 "Freedom Award" for its advertising campaign backing our system of economic freedom, which was cited as an outstanding contribution to the principles of freedom. This campaign, which was begun over ten years ago, is one of the first of this type instituted by industry. The award is made by the Freedom Foundation, and the panel of judges was drawn from State Supreme Court justices and officials of American patriotic societies.

* * *

Shipments of steel products to automotive manufacturers in the first six months of 1949, according to *Steel Facts*, published by the American Iron and Steel Institute, were larger than in any previous half year. The total of nearly 5,900,000 tons shipped to this industry in the first half of 1949 was about 1,000,000 tons, or 20 per cent greater than in the first half of 1948, and 600,000 tons more than in the second half of that year. The shipments for the first half of 1949 equalled more than 17 per cent of the total steel shipments, compared with 15.2 per cent in the first half of 1948.

Engineering News

X-Ray Diffraction Employed to Study Materials at High Temperatures

Since the characteristics of most materials depend to a large extent upon the structural position of their atoms, the location of the atoms is of utmost importance in determining the properties of materials under different physical conditions. One method of location—X-ray diffraction—is based on the “reflections” of X-rays from atoms within a solid. X-ray diffraction cameras now commercially available permit the study of materials at temperatures up to about 1000 degrees C. A new camera, designed and built by the Westinghouse Research Laboratories, extends the limit up to 2000 degrees C.

In this camera, X-rays produced externally are beamed through a beryllium window in the side of the cylinder and strike the sample. Reflecting rays pass through a peripheral slit in the cylinder and strike a sensitive film mounted behind it, recording a pattern that indicates the atom arrangement of the sample. Auxiliary equipment makes it possible to maintain a certain atmosphere in the camera or change the atmosphere without disturbing the photographic action.

Recording Spectroradiometer Measures Color of Self-Luminous Bodies

To aid in the study of fluorescent materials, the search for new phosphors, and the design and manufacture of light sources, a color-sensitive instrument called a “recording spectroradiometer” has been developed by the General Electric Co. This device breaks up a light beam from any source into its spectrum, measures the relative spectral energy at each wave length, and makes a permanent record of the measurements in the form of a graph.

Electronic Accelerator Developed to Speed Elevator Travel

Sensitive vacuum-tube devices to accelerate the automatic dispatching of high-speed elevators have been developed by engineers of the Westinghouse Elevator Division, Jersey City, N. J. These electronic circuits transmit thousands of split-second impulses every hour, directing and spacing elevator cars so that they will be where they are wanted at the right time.

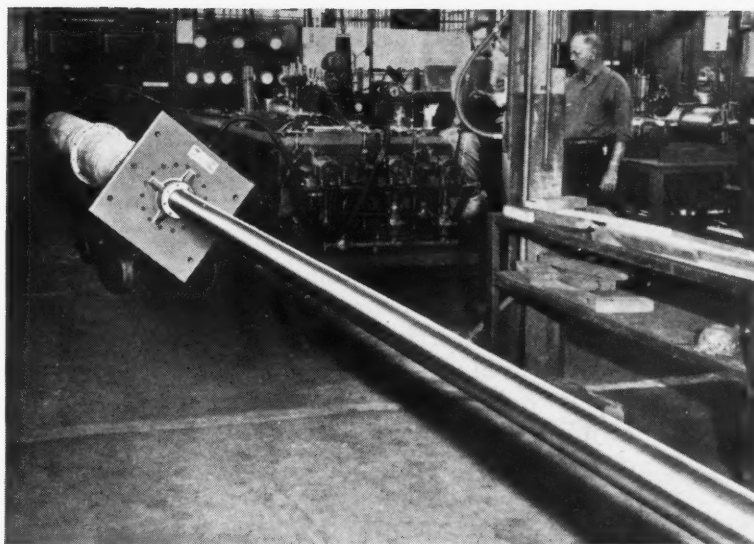
One of the new developments is an electronic timer, which serves as the core of the dispatching system. This device automatically signals the departure of cars from the top or bottom terminal at regular intervals. The interval is varied automatically between twenty and forty seconds in keeping with the demand. The heart of the timer is a vacuum tube that “fires” periodically, and in so doing signals one car to start and another to get ready. The new device replaces a motor-driven timer that required manual settings and adjustments, as well as the use of fourteen relays for each bank of six elevator cars.

Another addition to the automatic control system is the electronic counter. This device insures adequate service for the lower floors of a building at a time when some of the cars normally serving the lower floors have been transferred temporarily for use at the upper floors. The control sys-



The journal bearing boxes for railroad passenger cars shown here in production will be equipped with a new type of SKF anti-friction bearing, which is designed to cushion vibrations by giving the car axles greater freedom of lateral movement. These journal units will be provided on 100 new passenger cars being built for the Union Pacific Railroad

Huge hydraulic cylinder and piston for machines designed for casting heavy billets



tem splits a bank of elevators into two groups—one to serve lower floors, and the other upper floors. Adjustments are made automatically to suit varying traffic conditions, so that when there is an unusually large number of calls for service in the upper floors, low-zone cars will be speeded to help meet the demand. However, when demand from the lower floors increases and requires the attention of the regular low-zone cars, the electronic counter will prevent them from continuing their emergency duty in the high zone.

A further development, applicable to all automatic elevator systems, is an electronic timer that automatically shuts down the motor-generator set of an elevator when no calls have been received for a specified period—generally from two to five minutes. This device replaces a complex mechanical apparatus and results in considerable savings in power costs.

Swiss Watch Provided with a Slide-Rule

Swiss watchmakers have developed a time-piece with a precision slide-rule built around the dial. The slide index, which is made of unbreakable glass, is rotated by turning the rim in which the watch crystal is mounted.

Mammoth Hydraulic Cylinders for Casting Machines

Two hydraulic cylinders believed to be the largest of their type ever built have recently been completed by the Logansport Machine Co., Logansport, Ind. These cylinders were built for the Reynolds Metals Co., to be used in machines designed for casting heavy billets.

The huge cylinders have a bore of 14 inches; a stroke of 237 inches; a stainless-steel piston 5 inches in diameter; and a piston-rod weighing 1600 pounds. The total weight of the cylinder and piston is 3 1/2 tons, and the length of the equipment, with piston-rod extended, is approximately 500 inches. The cylinder holds about three barrels of oil, and imparts an impact force of 76,000 pounds when operated at a pressure of 500 pounds per square inch.

Cathode-Ray Tube Registers Five Phenomena at a Time

A new cathode-ray tube that registers five independent phenomena on a single 5-inch, flat-face screen has been developed by the Electronic Tube Corporation, 1200 E. Mermaid Lane, Philadelphia 18, Pa. This electronic tube should find wide application in industry, medicine, and government research, since it expands the means for accurately comparing various phenomena that occur simultaneously.

Giant Electric Motors Develop 25,000 Horsepower

Two huge electric motors, each of which develops 25,000 horsepower and is capable of churning up air comparable to that which exists in a 1500-mile an hour gale, have been installed in the Ames Aeronautical Laboratory at the Moffett Air Force Base, Calif. These twin motors, which were built by the Westinghouse Electric Corporation, are the highest speed motors of their size ever built with wound rotors. They drive a giant air compressor 33 feet in length and 400 tons in weight.

Automatic Lubricating System for Punch Presses

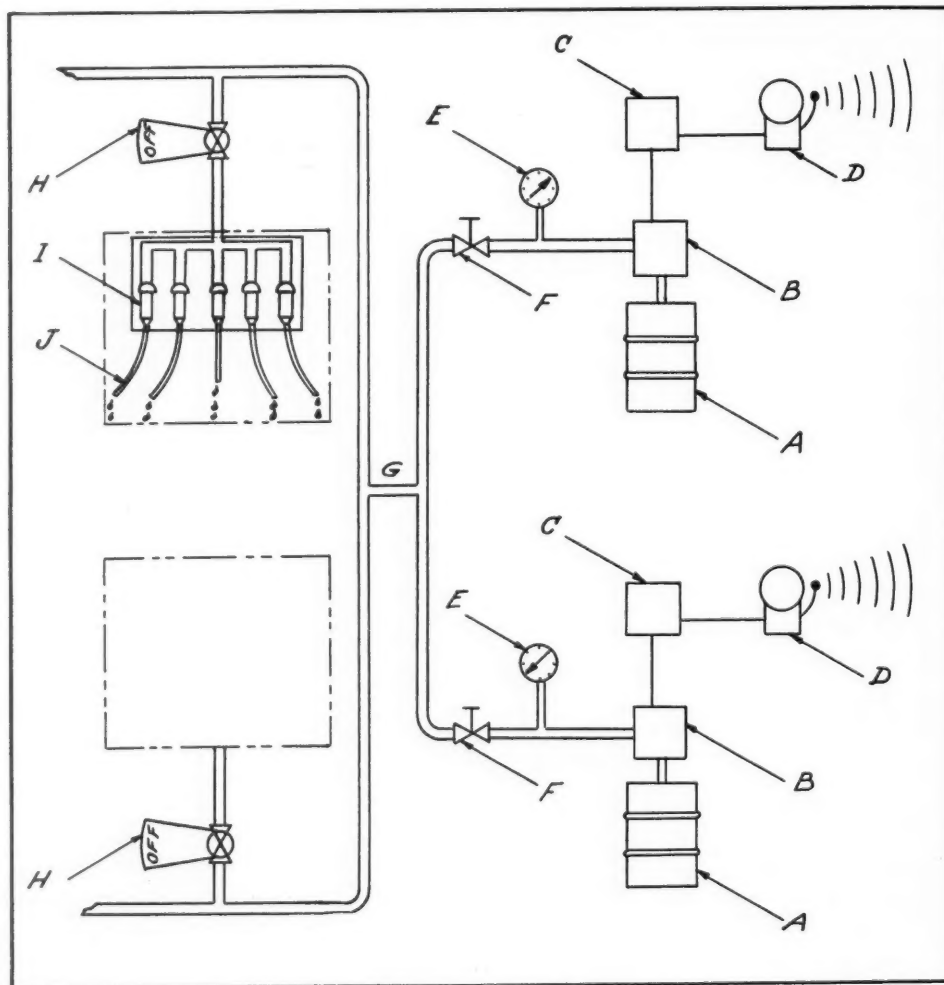
By ALFRED DUGLIN
Punching, Tool, and Die Division
General Electric Co., Schenectady, N. Y.

PERIODIC inspection and reconditioning of punch presses at the Schenectady Works of the General Electric Co. indicated the need for an improved system of lubrication. Although reconditioning of the presses produced good results initially, within six months after overhauling, inspection showed excessive wear of the crankshaft and pitman bearings, as well as wear and scoring of the ram ways. These conditions were evidently attributable to inadequate lubrication.

The presses were equipped with the standard type, manually operated central pump systems. Actuation of the pump forced lubricant through the lines at high pressure to all wear points. Such systems present certain difficulties. There is a tendency toward over-supply at the time of application. Furthermore, either the press operator or a person designated as an "oiler" must

be depended upon to actuate each press pump at definite intervals. This offers no positive assurance that there is always sufficient lubrication nor that the lubricant is applied at the right time. Even the establishment of definite intervals between periods of lubrication presents a problem, since certain types of work, such as progressive die work, can usually be performed at a greater number of strokes per minute than compound die or form die work, and therefore requires more frequent lubrication.

Crankshaft and pitman bearings are subjected to extreme pressures, and must withstand the full punching load applied as an impact force. The maintenance of an adequate film of lubricant between these bearing surfaces and the shafts is further complicated by the intermittent motion of the crankshaft, which allows the lubricant to drain toward the bottom of the bearing when the



Automatic pressure lubricating system for the efficient lubrication of groups of punch presses. The diagram shows two units, one of which serves as standby equipment for emergency purposes

shaft is idle. The punching pressure, however, is applied between the shaft and the top of the bearing after the shaft has revolved nearly 180 degrees. This requires the lubricant to be carried to this area during every working stroke of the press. It can readily be appreciated that a generous amount of lubricant, of the proper viscosity, must be continually maintained in the bearings to insure satisfactory performance.

Ram ways present another difficult lubricating problem. Considerable bearing area is involved, while a maximum clearance of 0.002 inch between ram and gib prevents the application of a heavy film of lubricant. Since it is rarely possible to have an exactly balanced cutting pressure located about the center line of the ram, due to press deflection, irregular blank contours, etc., there is a tendency for the ram to crowd to one side in the ways during the pressure period. Such action forces the lubricant out, and unless it is quickly replaced, excessive wear and scoring soon result.

Excellent control of these press lubrication problems has been obtained through the use of an automatic pressure system, which is designed to service entire lines or groups of presses simultaneously. A schematic outline of such a system is shown in the accompanying illustration. It will be seen that this consists essentially of a main oil supply and a pressure pump with suitable controls and the necessary piping to carry the oil at high pressure to the presses in the group. Each press is connected to this line, from which oil is fed to flow metering units installed on each press at every point requiring lubrication. The standby equipment shown in the diagram is not essential, but can readily be included in plants where it is the policy to maintain such equipment.

Either a special tank or a standard oil drum can be utilized for the main oil supply *A*, which is centrally located at some convenient point relative to the group of presses to be serviced. An alarm gong *D* warns when the supply is nearly exhausted. The pump *B*, mounted adjacent to the oil supply, must be of sufficient capacity to supply the amount of oil required by the group of presses at a pressure of about 3000 pounds per square inch at the pump. One installation services twenty-five presses having an average of twelve metering outlets per machine. Additional presses can be added to this group without overloading the pump.

The electrical control system *C* has several important functions. An adjustable timing device can be set to start the pump automatically at from fifteen- to thirty-minute intervals, after which it requires about eighty seconds to build

up to the required 3000 pounds pressure. The pump is shut off by a pressure switch when the pressure reaches this amount. In the event that this pressure is not reached within three minutes (this period is adjustable), the control system shuts off the pump and sounds the alarm gong. Protection against insufficient oil supply, line leakage, or pump trouble is thus provided.

Clean hydraulic piping *G* carries the oil from the pump to the metering units on the individual machines. A pressure gage *E* and a shut-off valve *F* are provided near the pump as shown. There is another shut-off valve *H* at each press to control waste when the press is idle. This valve is equipped with a large metal signal flag which gives visual assurance that the line is open when the press is in operation. Copper or flexible tubing *J* carries the oil to the points to be lubricated from the metering units *I*. Each metering unit must be adjusted to supply the exact amount of oil needed in the particular area it services.

The use of this automatic lubricating system has resulted in substantial savings, such as reduction in press maintenance, improved utilization of manpower, and longer die life. The presses that required a second major overhaul after only six months with the manual lubricating system have now been in continuous operation for over one and one-half years without major maintenance. Inspection after this period of operation showed no serious wear of the crankshaft or of the crankshaft and pitman bearings. Furthermore, the ram ways were in excellent condition.

* * *

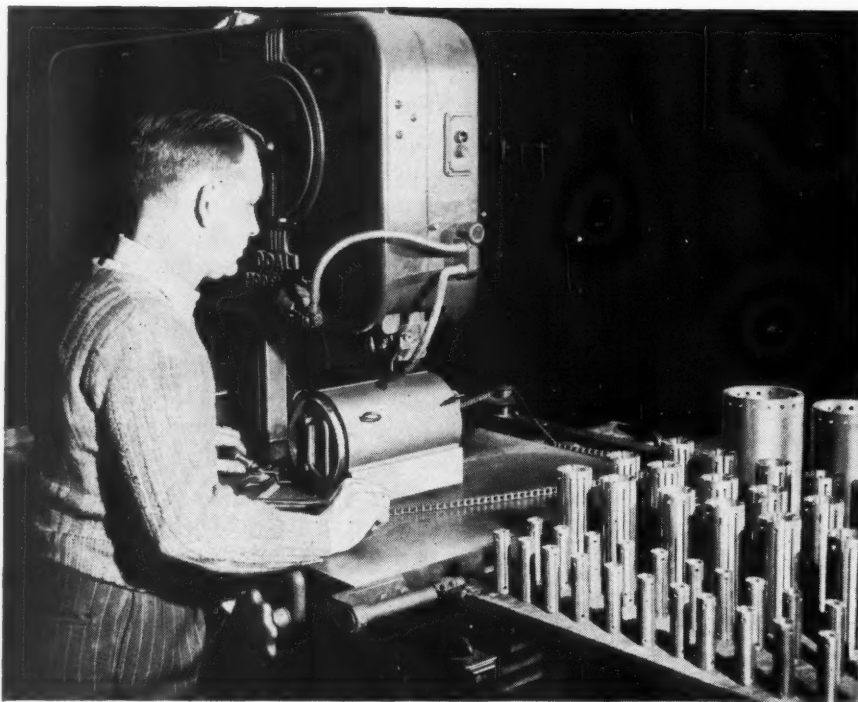
Award Program to Stimulate Advances in Die-Casting

An award program intended to stimulate advances in the die-casting industry from year to year has been announced by the American Die Casting Institute. Awards have been made possible by a fund donated by the Doehler-Jarvis Corporation. There will be a cash award of at least \$500, and an appropriate plaque presented each year to an individual or to a related group of individuals making the most noteworthy contribution to the industry. Selection of recipients of the award will be made by the board of directors of the Institute.

* * *

About four hundred automotive parts are now being die-cast. Most of them are of zinc alloys, but aluminum die-castings are being increasingly used, replacing many cast-iron parts.

Contour Sawing Made Easy



Production has been Increased and Costs Reduced by the Use of Special Work-Holding Devices and Semi-Automatic Feeding and Indexing Fixtures on Continuous Sawing Machines

MANUFACTURERS searching for methods of reducing costs might profitably explore the possibilities of improving production or decreasing machining costs by the use of special work-holding devices and semi-automatic feeding and indexing fixtures. Examples of the application of such fixtures to contour sawing machines made by the DoAll Co., Des Plaines, Ill., are described in this article.

Fixtures of this type have extended the field of metal-cutting band saws from tool- and die-making operations to the production lines of many varied industries. Fixtures operated by gravity, electricity, and hydraulic or air power

result in more economical labor requirements, faster production, and closer control of tolerances, cutting rate, surface finish, and operational sequence.

A band-sawing fixture employed by the Patton Mfg. Co., Springfield, Ohio, for slotting expanding mandrels is seen in the heading illustration. Uniform cuts, evenly spaced and parallel, are obtained, and various size expanding mandrels can be quickly slotted. A spring-loaded shot-pin enters holes in an indexing bushing as the work is rotated in the fixture to locate the work in the required position. Bushings with different numbers of holes are provided to suit various sizes

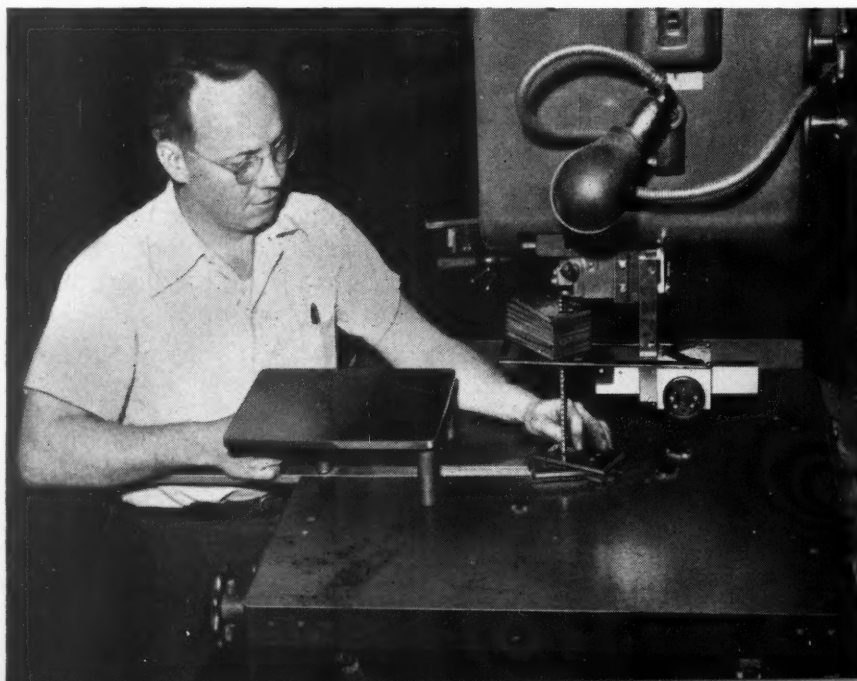


Fig. 1. Increased production and longer blade life are obtained with this set-up for making multiple internal cut-outs with only one weld of the blade

by the Use of Fixtures

of mandrels. Standard power feed provided on the sawing machine is employed to feed the fixture and work past the saw blade.

It is general practice in contour sawing to weld the saw blade each time an internal cutting operation is performed on a part. However, internal contour sawing of many different pieces can be accomplished with only one blade weld by means of the ingenious set-up shown in Fig. 1. Production has been increased as much as 65 per cent by the application of this fixture on contour sawing machines in the East Pittsburgh, Pa., plant of the Westinghouse Electric Corporation.

As many as twenty different pieces, each having a pilot hole for the insertion of the blade, have been placed on the blade and cut, one by one, to various shapes. After welding the blade and placing it on the sawing machine, the stack of work-pieces is positioned on the jackknife type, folding-arm rack shown attached to the saw-guide post. The bottom piece in the stack is slipped through the rack by opening the folding arm, and placed on top of the sliding auxiliary table seen being held in the operator's right hand.

When the part has been sawed to the desired internal contour, the auxiliary table is withdrawn from the saw to the position shown and the part is dropped onto the regular table. This process is repeated until all the pieces have been completed. Since the blade passes through the finished as well as the uncut pieces, it is advisable to clamp both stacks securely in position to prevent contact of these pieces with the saw teeth. In addition to the increased production obtained with this set-up, blade-life is greatly

lengthened, since cutting and rewelding of the blade are minimized.

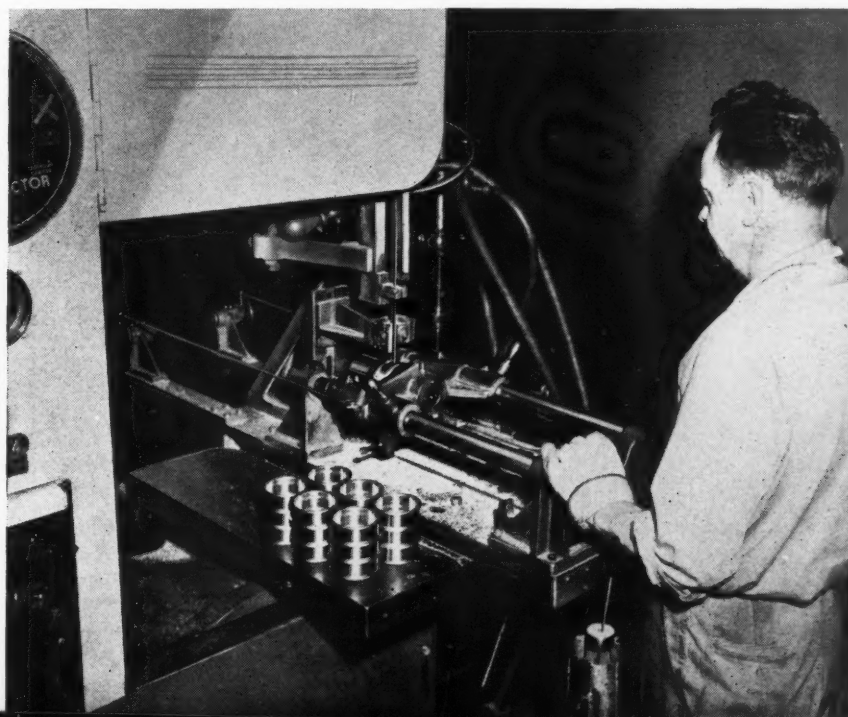
Quick-return, air-operated work-holding fixtures, such as the one illustrated in Fig. 2, are provided on continuous sawing machines in the plant of the Cleveland Graphite Bronze Co., Cleveland, Ohio, to speed up the production of bearings. Plain bronze bearings are slit in as short a time as ten seconds, depending upon the size of the bearing. This continuous production job is performed to precision tolerances, and a smooth surface finish is obtained on the bearing halves.

Gravity power feed, which is standard equipment on the sawing machines, exerts a pressure of 23 pounds to feed the work past the blade. A compressed air cylinder, acting on the work-holding fixture, quickly returns the split bearing to the starting position. Metal-cutting band saws having a 26-inch throat are employed for this operation. The saw blades, which are $\frac{3}{4}$ inch wide and have 18 teeth per inch, are rotated at a surface speed of 100 feet per minute.

Another example of greatly increased production obtained by means of a quick-acting fixture is illustrated in Fig. 3. This set-up employed in the plant of the Dodge Mfg. Co., Mishawaka, Ind., slits special tapered bushings that are used to lock V-belt sheaves on shafts. The operation is performed in a fraction of the time previously required by milling. The cycles for various size taper locks range from 10 to 45 seconds per bushing.

Semi-automatic operation is obtained by means of this hydraulically operated, double-acting fixture. The operator merely slips a bushing on the

Fig. 2. Plain bronze bearings are quickly split to close tolerances on metal-cutting band saws equipped with air-operated, quick-return work fixtures



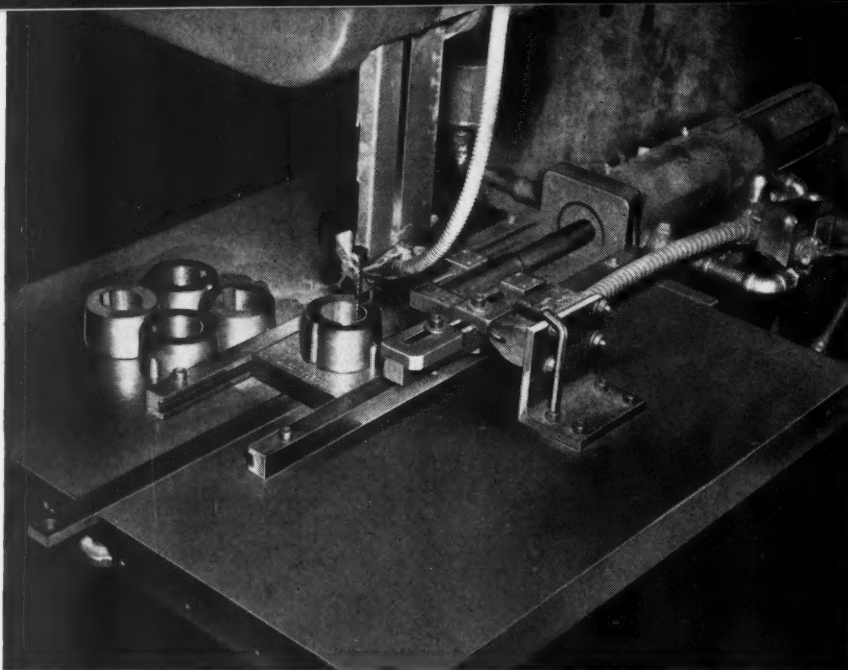


Fig. 3. Semi-automatic operation in the slitting of special tapered bushings is obtained by means of a hydraulically actuated, double-acting work-holding fixture



Fig. 4. Large radii are produced quickly and accurately on steel plates 1/4 inch thick by the use of a radius-sawing fixture

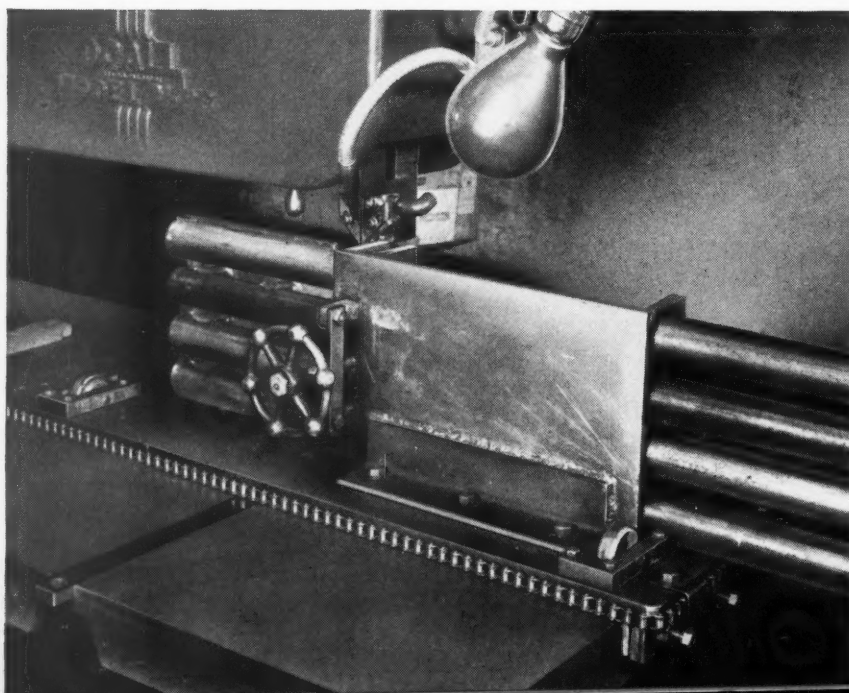


Fig. 5. Production sawing of long pipe to different lengths is facilitated by a fixture which permits cutting four pipes at one time

pins projecting from the slide of the combination holding and feeding fixture. The bushing is automatically fed past the saw blade by hydraulic pressure, which is adjustable from 22 to 30 pounds, depending on the size of the work. Since each bushing is slit on only one side, the length of stroke of the work-slide, or depth of cut, is accurately controlled by a cam-actuated limit switch. The slide is reversed before the back edge of the saw blade leaves the cut, carrying the slit bushing back to the starting position for unloading. A blade 1 inch wide having ten teeth per inch is employed at a surface velocity of 100 feet per minute.

End pieces for water-screen baskets made by the Chain Belt Co., Milwaukee, Wis., are quickly formed to the desired radius by means of the simple fixture seen mounted on a DoAll friction sawing machine in Fig. 4. The swinging T-shaped arm of the fixture pivots about a pin projecting vertically from an iron strap bolted to the inner edge of the saw table. The steel plate to be cut, which is 1/4 inch thick, is positioned on two pins projecting from the outer edge of the swinging arm. By simply swinging the arm toward the saw blade, the large radius is accurately produced on the periphery of the plate. These parts were formerly cut to the desired shape by oxy-acetylene torches at a cost more than three times as great as with the present method.

Considerable time is saved in the production sawing of long pipe to various lengths by the fixture seen in Fig. 5. With this arrangement four pipes can be accurately cut to the desired length at the same time. The fixture is mounted on the table of a 36-inch throat metal-cutting band saw in the plant of the Wertz Engineering Co., Reading, Pa.

In addition to passing through openings in the welded-steel fixture, the long pipes are supported by a hanger that is suspended from a monorail conveyor track at the right of the machine. The base of the fixture is fitted with anti-friction bearing wheels, which extend through the fixture and contact the table top to facilitate feeding the pipes past the band-saw blade. The standard power feed of the machine is employed. When four lengths of pipe have been cut off, the pieces are stacked in a bin behind the operator and the pipes are advanced to a pre-set stop on the left-hand end of the fixture.

Many duplicate pieces can be produced in a single operation on metal-cutting band saws by clamping together stacks of sheet metal. Long pieces can be handled in this way by building a large, ring-shaped frame of welded pipe at work-table height around the machine. Such a



Fig. 6. Stack-sawing of long sheets is facilitated by building a ring-shaped work supporting frame at work-table height around the machine

Fig. 7. Gear-driven friction rollers are employed on a special fixture to feed long, heavy channels and beams past the saw blade



set-up, used in the plant of the Federal Aircraft Works, Minneapolis, Minn., is shown in Fig. 6. The long sheets, rigidly clamped together in a stack on a templet, are supported between the work-table and the ring frame, and can easily be manipulated to the desired positions by the operator, for sawing in any direction.

In this plant, long duralumin sheets are sawed to various shapes in this way, and are then bent and assembled with mounting brackets to produce skis for light airplanes. A saw blade 1/4 inch wide, with 4 teeth per inch, operating at a speed of 325 feet per minute, is employed for stack-sawing. Using a light feeding pressure, the cutting rate is 20 square inches a minute.

The cost of making angular cuts on long, heavy steel channels has been substantially reduced at the Koehring Co., Milwaukee, Wis., by means of the special work-holding and feeding fixture shown in Fig. 7. Large size work that cannot be handled manually can be accurately sawed in this way. Beveled edges are produced on the steel channel shown, which is 15 feet long by 15 inches wide.

Manually operated, gear-driven friction rollers feed the channel past the saw blade. A saw blade, 1 inch wide and with 14 teeth per inch, is operated at a velocity of 125 feet per minute for this operation. The cutting rate is 1.60 square inches per minute.

Determining Radial Clearance on Thread Milling Cutters without Lead

By E. S. ZOOK, Detroit Tap & Tool Co., Detroit, Mich.

REFERRING to the article published in the September, 1949, issue of *MACHINERY*, page 158, entitled "Determining Radial Clearance on Thread Milling Cutters without Lead," by Sherwood C. Bliss, we would like to point out an error. In the third paragraph, Mr. Bliss says: "Although a single-point threading tool is shown, the formula, which is based upon the theory of limiting values, applies with equal accuracy to so-called multiple-thread type milling cutters." We disagree with this statement, and offer the following as proof.

The travel of single-point tools and of multiple-thread milling cutters across the work can be resolved into two components, one parallel to the axis of the work and one normal to the axis of the work. In the case of a single-point tool, the normal travel is the speed of the work, which is also the cutting speed. If we consider a 3-inch bar rotating at 128 R.P.M., we have a normal speed of 100 feet per minute. Now if we gear the lathe to cut an 8-pitch thread, we will also have a travel parallel to the axis of 1/8 inch per revolution with a speed of 128 R.P.M. We therefore have an axial travel of 16 inches per minute, while the normal travel is 100 feet or 1200 inches per minute. The resultant travel is at an angle to the normal to the axis of the work, and the tangent of this angle is 16 divided by 1200, or 0 degrees 46 minutes, the helix angle of the thread being cut.

Consider now a multiple-thread milling cutter milling the same 3-inch, 8-pitch thread. We ro-

tate the cutter at a peripheral speed of 100 feet per minute, which, as in the case of a single-point tool, gives a tool travel normal to the axis of the work of 100 feet per minute. There is also an axial travel. If we thread the piece in one minute, as we did before, the work will rotate one revolution and also travel axially one pitch. In other words, the normal travel of the cutting edge is 100 feet, while the axial travel is 1/8 inch. The resultant travel makes an angle with the normal, the tangent of which is 1/8 divided by 1200, or an angle of less than one minute—generally an insignificant amount.

From the foregoing comparison, it is evident that there is no relationship between the relief requirements of a single-point threading tool and of a multiple-thread milling cutter, and also that the helix angle of the work has very little effect on the relief required on a multiple-thread milling cutter. This being the case, the entire article is erroneous, and the formula given has no bearing on the actual relief required on a milling cutter.

[In reply, Mr. Bliss has admitted his error, but states that the only result, fortunately, of the use of his formula will be more radial clearance than is needed on some cutters.—EDITOR]

* * *

One automotive firm spent over \$300,000 for a new set of fender dies in 1949, ordinarily three times as much as similar dies cost in 1941.

Design of Internal Broaches

By J. R. PAQUIN
Tool Engineering Consultant
Hartford, Conn.

ONE of the first considerations in designing an internal broach is to determine the depth of cut; that is, the amount of metal to be removed per tooth. If the depth of cut is too light, the teeth may drag over the metal with a burnishing action when the broach has become slightly dull. This will quickly ruin the cutting edges and result in tearing and galling of the work surface. Too heavy a depth of cut may cause broach failure as a result of the overload applied to the teeth. The choice of the correct depth of cut depends on the material to be broached, the length of the cut, and the cross-sectional size of the broach.

The tool engineer must know exactly what is meant by "depth of cut" before he can apply it properly. For internal broaches, "depth of cut" has the following significance:

Applied to round broaches, it means the increase in diameter per tooth, or the difference in the diameters of adjacent teeth.

Applied to square, rectangular, and hexagonal broaches, it refers to the difference in size between adjacent teeth, measured across corners.

Applied to spline broaches, it means the difference between the diameters of adjacent circular series of teeth.

Applied to internal keyway broaches, it refers to the difference in height between adjacent teeth.

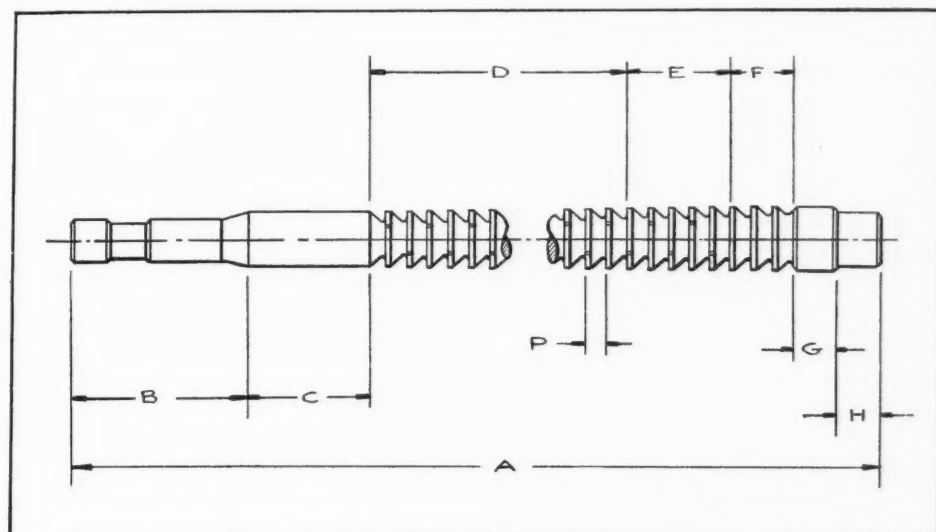
As a general rule, not less than 0.001 inch of stock should be removed by each broach tooth.

Comparatively large broaches—over 2 inches in diameter—may take off from 0.008 to 0.010 inch per tooth when considerable material must be removed. A finish broach, used only for sizing and to produce a smooth surface, may remove 0.001 to 0.0015 inch per tooth, regardless of size.

In cutting steel, medium-size round broaches should remove from 0.001 to 0.003 inch of material per tooth. When splines are to be broached, a depth of cut of 0.003 to 0.006 inch may be used. For broaching square, rectangular, and hexagonal holes, the depth of cut should be 0.0035 to 0.005 inch, while for internal keyways, it should be from 0.003 to 0.006 inch. Soft cast iron or brass requires about twice these amounts.

Once the depth of cut for each tooth has been established, it is possible to compute the total number of teeth for the broach. This is done by dividing the total amount of stock to be removed by the depth of cut. To this is added the number of finishing teeth required (usually three or four), and the number of safety teeth, if any. Safety teeth are added to the front part of the broach, and do no cutting unless the work is under-size. Under these conditions, the safety teeth will size the hole before the first actual cutting tooth takes a chip. Without them, under-sized work would probably break the first tooth because of the sudden overload applied to it. If a front pilot of accurate size is used on the broach, however, they are unnecessary, as under-size parts will not permit entry of the pilot.

Fig. 1. Diagram of a typical internal broach in which (A) indicates the over-all length; (B) the front shank; (C) the front pilot; (D) the roughing teeth; (E) the semi-finishing teeth; (F) the finishing teeth; (G) the rear pilot; (H) the follow-rest pilot; and (P) the pitch



Calculating Pitch of Broach Teeth and Total Broach Length

Next in line in the design sequence is the calculation of the pitch. This is the distance from one point on a tooth to the corresponding point on the adjacent tooth, as indicated at *P* in Fig. 1. The value arrived at by the solution of the following formula will be the correct one for average conditions:

$$\text{Pitch} = 0.35\sqrt{L}$$

where *L* = length of cut.

From two to five teeth should always be in contact with the sides of the work during the cut. Of course, at the beginning and end of the cut, fewer teeth are in contact, but the broach is supported by the front and rear pilots, which are a snug fit in the hole and prevent chatter and bell-mouthing of the part opening.

When fewer than two to five teeth are acting upon the part simultaneously, there will be a great deal of chatter and the surface of the work will be impaired by chatter marks. If more teeth are acting on the part, the pressure required to move the broach may be excessive, and the possibility of broach fracture will be correspondingly greater.

To reduce vibration, with its resultant chatter marks on the work, the pitch of internal broaches is often varied. This is called differential spacing, and is generally done in groups of two teeth, or, at times, in groups of three. The variation in pitch is usually very slight, corresponding to the angular variation applied to reamer teeth in order to eliminate chatter.

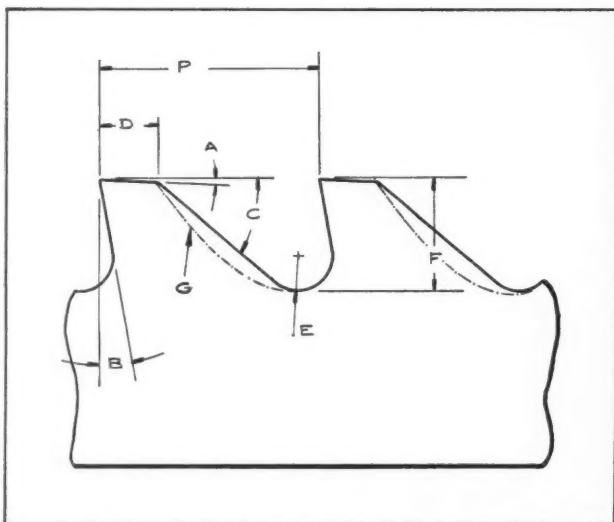


Fig. 2. Roughing and semi-finishing teeth are usually of the form shown. The angular style is shown by full lines, and the loop style, which has a curved chip clearance, by dot-and-dash lines

After the number of roughing, finishing, and safety teeth (if any) and the pitch have been established, the over-all length of the broach is determined as follows: The roughing, finishing, and safety teeth are added, and the sum is multiplied by the pitch. To this is added the lengths of the front and rear pilots, the follow-rest pilot, and the broach shank. A typical broach with the various parts indicated by reference letters, is shown in Fig. 1. If it is found that the length of broach thus determined is too great for the stroke of the machine or greater than is practical for a given broach diameter, it becomes necessary to design a set of broaches for doing the work in two or more operations.

Factors Influencing Choice of Tooth Form

Fig. 2 illustrates the correct form for angular style and loop style of teeth, the former being shown by full lines and the latter by dot-and-dash lines *G*. The angular tooth form is the stronger of the two, but does not have as great a chip space as the loop style. Choice of the proper style of tooth will depend on the toughness of the material to be machined. The tougher the material, the more closely will the tooth form follow the angular style.

The clearance angle *A* greatly reduces friction between the top surface of the tool and the wall of the part. For roughing teeth, it should be 2 degrees. The width of the land *D* should be approximately one-fourth the pitch, and the depth of tooth *F* about one-half the pitch, maximum.

Angle *C* should be from 35 to 40 degrees, the latter value being considered correct for the majority of broaching operations. The lowest value (35 degrees) can be employed for broaches to be used on extremely tough materials. Radius *E* is generally less than one-half the tooth depth *F*. It is a blending radius, and should be as large as practicable.

Rake angle *B*, which is very important, determines the cutting action of the tooth. It varies from 2 to 15 degrees. Teeth for cutting bronze, cast iron, and malleable iron generally have from 2 to 6 degrees rake angle. Cast steel and steel forgings can be broached successfully by the use of a rake angle of 7 to 10 degrees. Aluminum requires 10 to 12 degrees, and copper and mild steel, 12 to 15 degrees.

Finishing teeth differ slightly in form from roughing and semi-finishing teeth. Part of the land *D* is left flat and parallel with the axis of the broach. This flat land is from 1/64 to 1/32 inch wide. Clearance angle *A* is less than the clearance on the roughing teeth, generally being only 1/2 degree.

Application of Shear Angles

Shear angles may sometimes be applied to the teeth of square or rectangular broaches, but are generally unsuccessful on other shapes of internal broaches. The shear angle varies from 5 to 20 degrees, depending on the extent of the cut, the width of the broach, and the material to be machined. When shear angles are used on square or rectangular broaches, the angles on opposite sides of the broach must be in opposite directions, as indicated in Fig. 3, in order to balance the lateral force acting in a direction perpendicular to the cutting force and parallel to the surface generated. This prevents the broach from "crowding over," making the hole in the part inaccurate in relation to the outside surface.

Importance of Chip-Breakers

Chip-breakers are always necessary on internal broaches that take a full cut—that is, one in which the entire periphery of the tooth is in contact with the part and removes a chip. These are small grooves, about 1/16 inch wide and from 1/64 to 1/32 inch deep, ground into the tooth parallel with the axis of the broach, as shown in Fig. 1. They serve to break up the chip for easy removal. Also, in the case of a wide cut and a wide chip, which is conducive to chatter, chip-breaker grooves remove the stock in a series of small free-cutting chips. Care must be exercised in applying chip-breakers to place them in a different axial position on each tooth. The finishing teeth, of course, do not require chip-breakers.

Steels Used in Making Internal Broaches

Broaches have been successfully made of carbon steel, molybdenum high-speed steel, carbon-vanadium tool steel, and even of casehardened machine steel. The recommended material for most broaches is carbon-vanadium tool steel. Adding vanadium to carbon steel allows the steel to be heated to higher temperatures without undue coarsening of the grain. It also produces a tough, dense core—an ideal condition for a broach.

After a carbon-vanadium steel broach is rough-machined, it should be stress-relieved by annealing. Then it is machined to pre-grinding dimensions, and hardened at a temperature of 1350 to 1400 degrees F. It is drawn at approximately 450 degrees F. to achieve a hardness of 60 to 63 Rockwell C.

Straightening of broaches after hardening

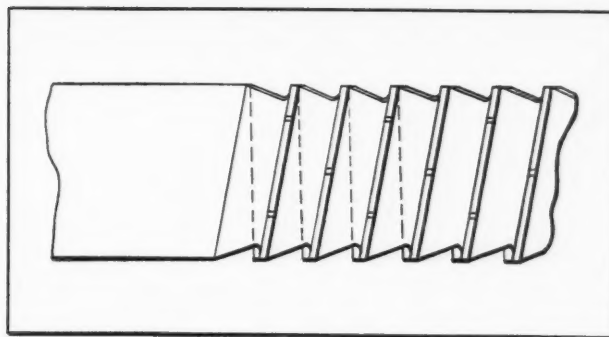


Fig. 3. Shear angles applied to the teeth of rectangular and square broaches must be in opposite directions on opposite sides of the broach, as shown, to balance the lateral forces produced by this design

can be accomplished in an arbor press at the same time that the temper is drawn, using the same heat. Occasionally, a broach will not require this operation.

The broach is tested to determine whether all the teeth cut equally by drawing it slowly through a part, the thickness of which is twice the broach pitch. The teeth that take too heavy a chip are stoned down. The broach is then pulled through successively thicker parts and the teeth stoned until it is pulled through a part that is equal in thickness to the part to be broached. In this manner, the danger of individual tooth fracture from overload is reduced to a minimum.

* * *

Motion Picture on Functional Photography in Industry

A new motion picture describing the ways in which photography is serving industry today in research, production, quality control, advertising, and sales has been produced by the Eastman Kodak Co.

The film, entitled "Functional Photography in Industry," shows not only the more familiar uses of photography, but also special photographic techniques for instrument recording, high-speed motion studies, engineering reproductions, templet making, metallography, spectrographic analysis, stress analysis, and geologic survey work. While much of the motion picture is in Kodachrome, black-and-white sequences have been included where normally used, as in high-speed motion studies.

The new film is available for showing before industrial groups and engineering societies. It is a 16-millimeter sound film, requiring thirty-six minutes' running time. Those interested can obtain further information from the Industrial Photographic Division, Eastman Kodak Co., 343 State St., Rochester 4, N. Y.

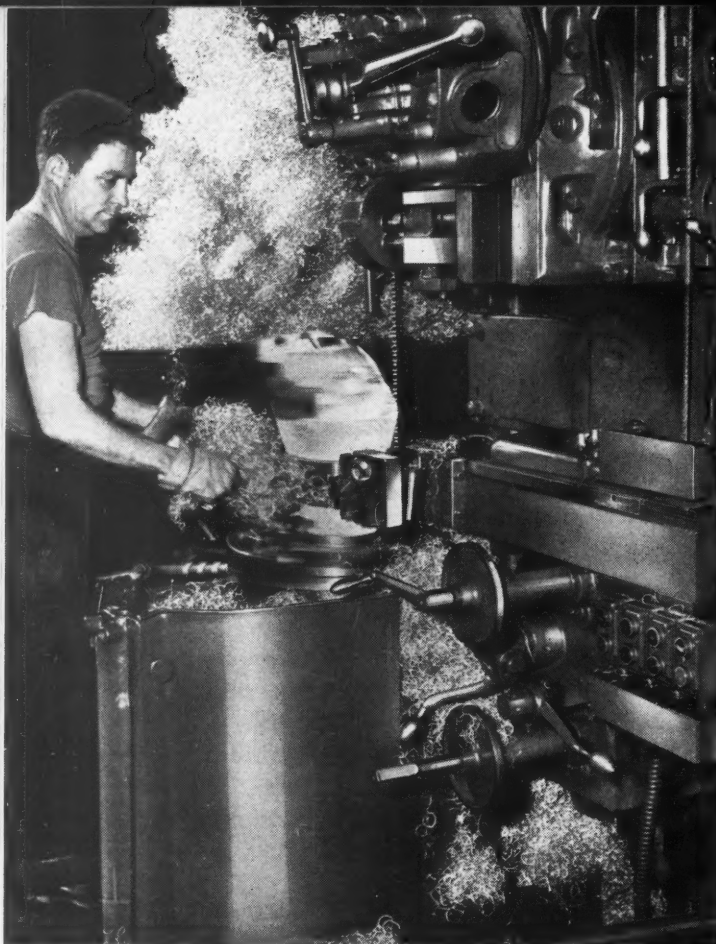


Fig. 1. Cooling fins are machined in the top of cylinder heads for the "Cyclone" engine in a two-spindle Hydro-Tel contour milling machine



Producing Wright High-Production

Some of the Uses Made of Contour Milling Machines, Cam Grinders, and Other Machines in Manufacturing Aircraft Engines at Wright Aeronautical Corporation

IN manufacturing the eighteen-cylinder "Cyclone" engine at the plant of the Wright Aeronautical Corporation, Wood-Ridge, N. J., to meet the exacting specifications required in power plants for modern aircraft, extensive use is made of high-production equipment. Although machines of this type are employed in the production of nearly all the parts that make up this high-power engine, those used for machining cylinder heads, barrels, and intake and exhaust cams are among the most interesting.

Specially designed Cincinnati Hydro-Tel contour milling machines are used for machining three groups of cooling fins in the forged aluminum-alloy cylinder heads. One of these machines is shown in Fig. 1 cutting the fins at the dome of the cylinder heads. Twenty-eight cuts, of varying depths and contours, are taken to form the fins in this group. The Hydro-Tel machine used for this operation has two spindles, each of which carries a narrow 13-inch diameter cutter with nine carbide teeth. These cutters operate at a speed of 4500 surface feet per minute and completely mill approximately fifteen cylinder heads before sharpening becomes necessary.

Opposite each spindle is a rotary table on which is mounted a square work fixture. A cylinder head is securely clamped to each face of the work fixture. In the foreground of the illustration may be seen another rotary table that supports four multiple-step cams. As this table rotates, the cams move the tool-spindles toward and away from the rotating work, thus controlling the form of the fins. A follower roll that engages the cams is attached to the spindle slide to produce this motion.

The cam table rotates at a surface speed of 70 inches per minute during the cutting operation. This rate is increased to 250 feet per minute after a cut is completed across the top of one cylinder head and the work fixture brings the next head into position for machining. A decrease in speed is made after the fourth cylinder

Aircraft Engines with Equipment

By GEORGE H. DeGROAT

head has been machined, in order to allow time for the follower to index to the next step on the cam.

Fifteen cuts, about 1 1/2 inches deep, are required to form the fins around the lower part of the cylinder-head body. The fins that surround the exhaust port are produced by sixteen cuts of varying depth and irregular root contour. In all cases, the spacing between the fins is 0.112 inch, and the fins range in thickness from 0.052 to 0.068 inch. The maximum depth of cut is 2 3/4 inches. The Hydro-Tel machine used for milling the fins around the body of the cylinder heads may be seen in Fig. 2. This four-spindle machine is similar in principle to the two-spindle machine employed for cutting fins in the tops of the cylinder heads.

Other operations in which Hydro-Tel machines are utilized include the contour-milling of the faces and bores of the intake and exhaust ports in the cylinder heads. The two-spindle Hydro-Tel machine illustrated in Fig. 3 is used for these operations. This machine is equipped with a tracer box and a tracer that imparts a transverse movement to the milling heads at the same time that the work-table moves horizontally. High-speed steel end-mills are used.

A machine similar to the one just described is employed to perform a rough-boring operation on the internal contours of the exhaust and intake ports, using two-fluted high-speed steel ball-shaped cutters. The finish-milling operation on these surfaces is accomplished on a three-spindle Cincinnati Hydro-Tel, as illustrated in Fig. 4.

In this machine, the work-holding fixtures oscillate while the table moves horizontally and the milling heads move transversely. The relative movements of these members is obtained by means of a tracer that follows the master contour in a tracer box, which also oscillates. Ball-shaped cutters are used in this operation too, in order to obtain a radius at the junction of the wall and the bottom of the hole.

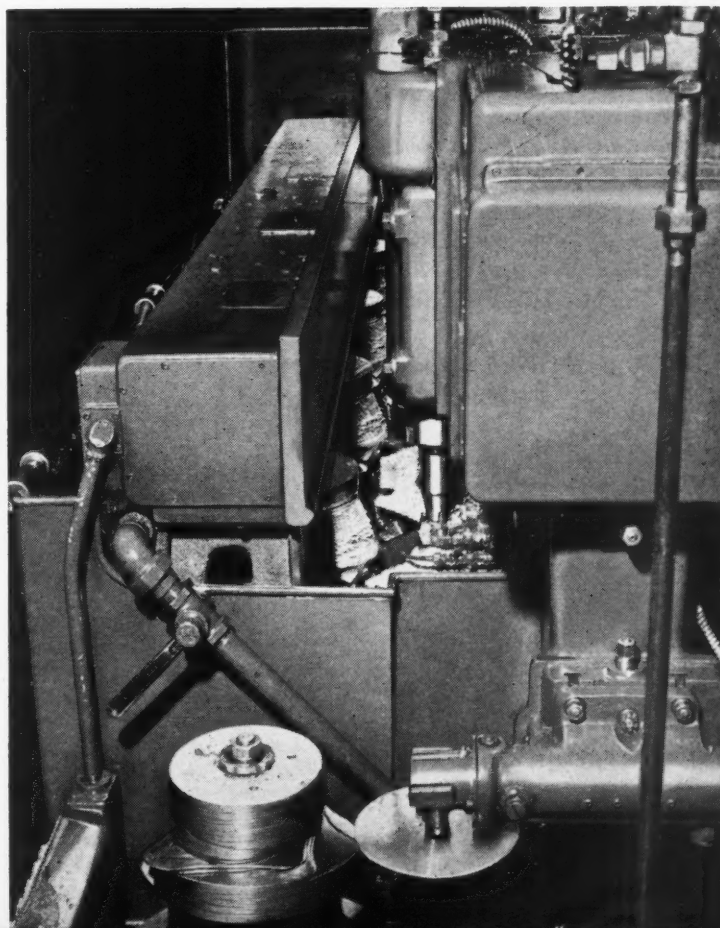
A special gage is used to inspect these internal contours, the dimensions of which are maintained within plus or minus 0.010 inch. Spindle speeds of approximately 1500 R.P.M. are employed, and the time required to finish-mill the exhaust and intake ports of one cylinder head is about fourteen minutes.

After a hole has been drilled to remove stock

from the rocker chambers of the cylinder heads, the work is placed in a two-station Hydro-Tel, where the rocker chambers are contour-milled in a manner similar to that described for the exhaust and intake ports. Straight side and end cutting tools are used for this operation, which requires approximately 9 1/2 minutes for each cylinder head. In this machine, the work is transferred from the first station to the second after one chamber has been contour-milled, and a new cylinder head is loaded in the first station. These contours, which are checked with a gage similar to the one just described, are held to within plus or minus 0.010 inch.

Another interesting operation performed on the cylinders is the assembly of aluminum air cooling fins in the barrels. These fins are formed in strips having a W-shaped cross-section. For assembling, the strips are loaded in two collecting blocks, which are placed in a specially designed hydraulic machine, Fig. 5. After a cylinder has been chucked in this machine, the two

Fig. 2. A four-spindle Hydro-Tel machine is employed for cutting cooling fins in the bodies of the forged aluminum cylinder heads



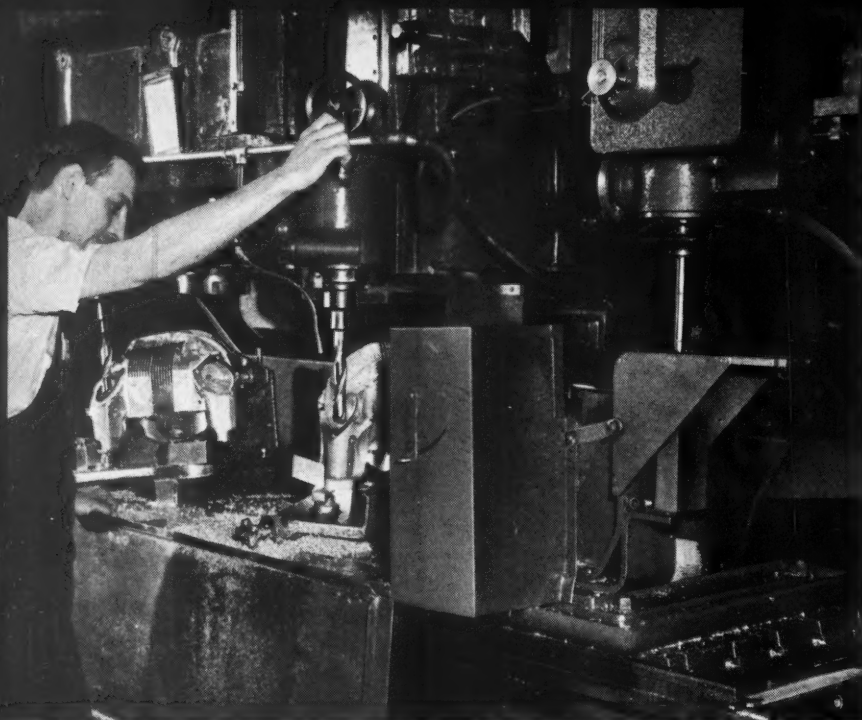


Fig. 3. The faces and bores of intake and exhaust ports in forged aluminum cylinder heads are contour-milled in a two-spindle Hydro-Tel

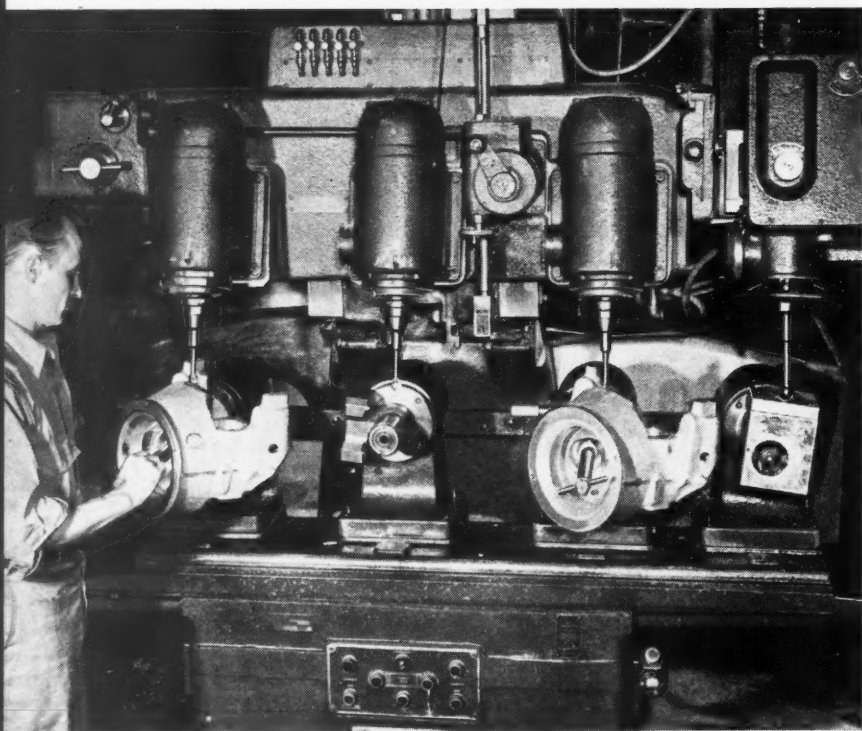


Fig. 4. Three-spindle Hydro-Tel machine used for machining the internal contours of intake and exhaust ports in the cylinder heads

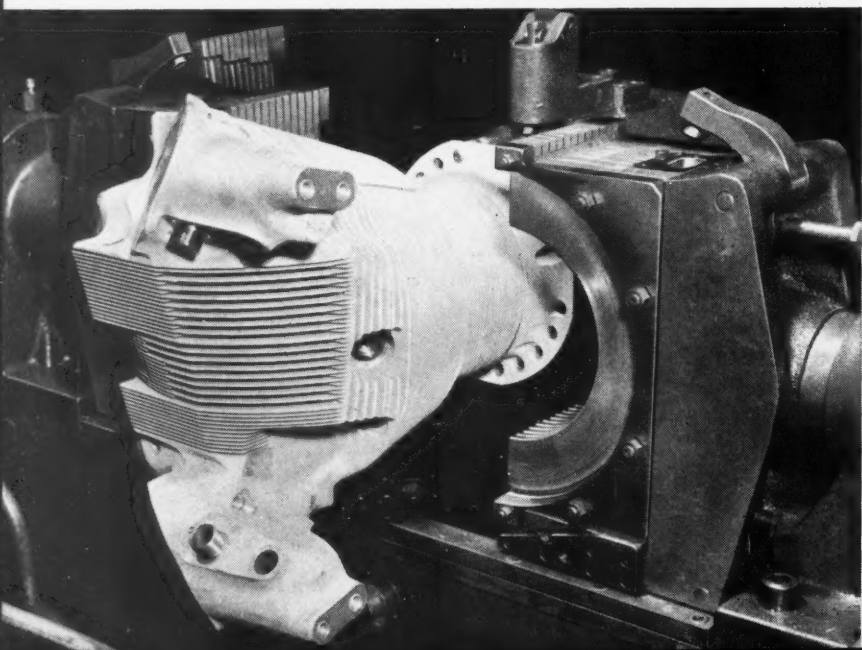


Fig. 5. Aluminum air cooling fins are inserted in tapered grooves in cylinder barrels by means of a hydraulic machine especially designed for the purpose

Fig. 6. (Right) Blades are fed through the cooling air fins to lock them in position as the cylinder rotates in this special machine

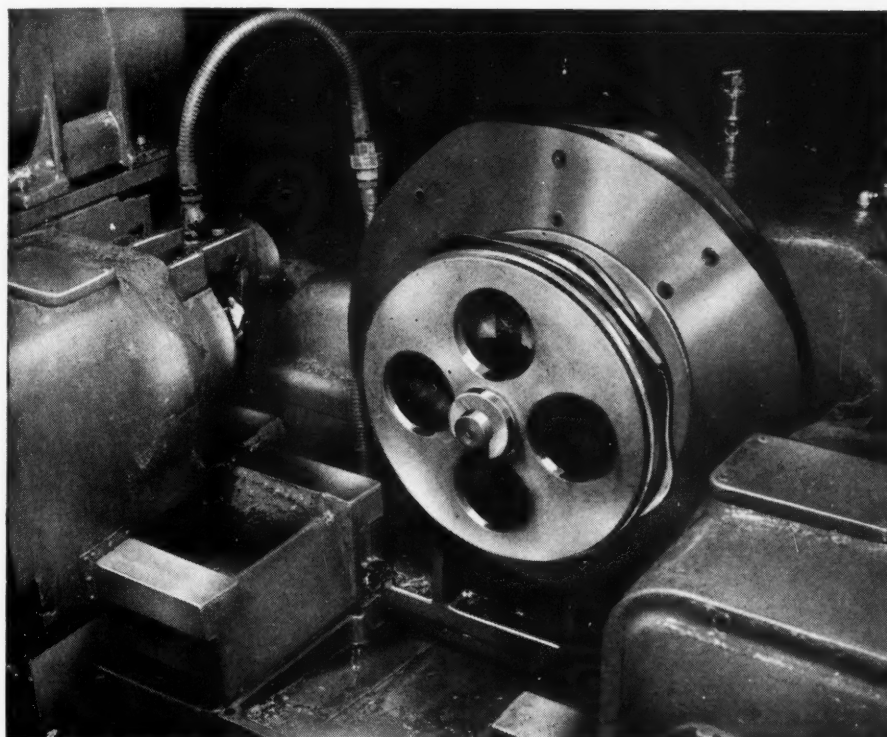
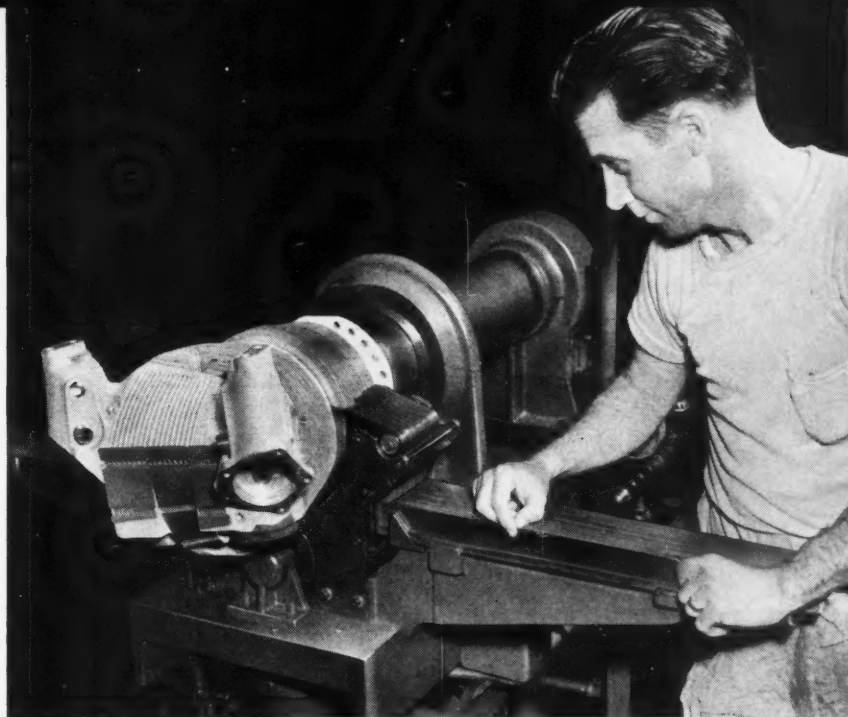
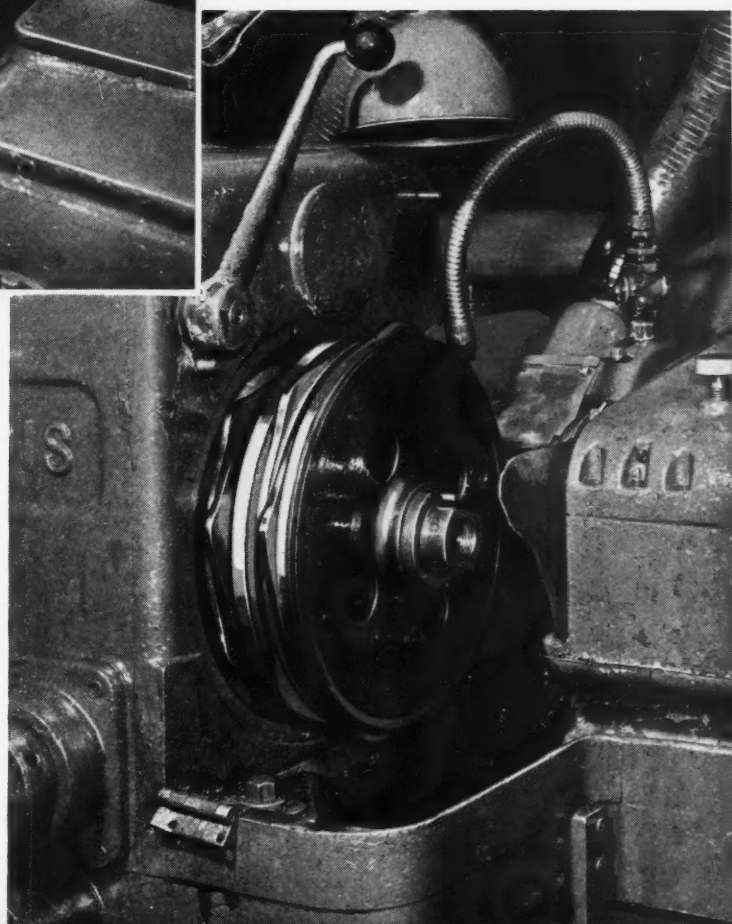


Fig. 7. (Above) Milling the lobes of intake and exhaust cams for the "Cyclone" engine is accomplished in a specially designed Van Norman contour milling machine

Fig. 8. (Right) Intake and exhaust cams are ground to close tolerances after they have been contour-milled and hardened



blocks come together to insert the fins in tapered grooves in the barrels.

The fins are securely locked in position by the machine illustrated in Fig. 6. Here the cylinders rotate while blades are passed through each fin to force them deeper into the grooves. A Bullard vertical turret lathe is then used to turn the fins to size, as shown in the heading illustration, after which they are spread or crimped at various points around their peripheries.

Inasmuch as there are two sets of valves for this eighteen-cylinder engine, two valve operating mechanisms are employed. The intake and exhaust cams employed to actuate the valve push-rods are made from nickel alloy steel forgings (Aeronautical Materials Specification No. 6260). Each cam contains eight lobes, four in each of two staggered banks, 90 degrees apart. The relative locations of these lobes are held to extremely close tolerances and their contours are held to within plus or minus 0.002 inch in machining.

A specially designed Van Norman contour milling machine, Fig. 7, is used for machining

these contours. The cam forging, which is held at the bore, and a master cam, are mounted together on a central spindle. Two internal gear teeth in the forging engage a locating finger to obtain the correct radial location of the cam lobes relative to the master cam.

Each of the two banks of lobes on the master cam are engaged by a roller on opposite sides of the work-spindle. The rollers are attached to cutter-heads having high-speed steel cutters which move in and out to cut the intake and exhaust lobes on the forging as the work-spindle revolves. Approximately sixteen minutes is required for one revolution, and both the intake and exhaust lobes on one cam are completely contour-milled in about twenty minutes.

After the milling operation, the cams are burred and then copper-plated on all surfaces except the lobes, the bore, and the internal gear teeth. Next, the gear teeth are recut and shaved, after which the cams are carburized to a depth of 0.036 to 0.040 inch. A Landis cam grinder is employed for grinding the cam lobes after hardening, as illustrated in Fig. 8.



The inside diameter of motorcycle connecting-rod bearings is checked instantly by the operator of this honing machine to within 0.0001 inch through the use of the Sheffield Precisionaire gage seen at the left of the illustration, which is operated from the regular compressed-air line of the plant

How to Estimate Costs of Lathe Operations in the Job Shop

Fifth in a Series of Articles on Estimating Machining Costs in the Job Shop, Covering All the Basic Types of Machine Tools

By HERBERT W. BROWN
Management Consultant

PREVIOUS articles have described the use of tables to facilitate the estimating of time for milling, planing, boring, and other machining operations. Similar tables can be employed for estimating purposes in connection with lathe work.

Among the tables recommended for simplifying the estimator's work are those that provide data on the capacities of the machines in his particular shop. For example, the specifications of the various lathes in a shop can be tabulated

to show the speeds and feeds available on each one, as well as other pertinent information, such as swing over the bed and carriage, distance between centers, range of threads, etc. The ready availability of this information will be useful to the estimator when considering the facilities of any given lathe in which the work is to be done.

Table 1 is another means of simplifying estimating procedure. In this table, the time required to take single cuts of different lengths on work of various diameters is shown. The time

Table 1. Typical Time Chart for Lathe Turning Operations

Diameter of Work, Inches	Length of Cut, Inches											
	1	2	3	4	5	10	15	20	25	30	40	50
	Time Per Cut, Minutes*											
1/2	3.40	6.81	10.21	13.61	17.02	34.03	51.05	68.06	85.08	102.09	136.13	170.16
1	6.81	13.61	20.42	27.23	34.03	68.06	102.09	136.13	170.16	204.19	272.25	340.31
1 1/2	10.24	20.47	30.71	40.94	51.18	102.36	153.54	204.72	255.91	307.09	409.45	511.81
2	13.61	27.23	40.84	54.45	68.06	136.13	204.19	272.25	340.31	408.38	544.50	680.63
2 1/2	17.04	34.08	51.11	68.15	85.19	170.38	255.57	340.76	425.95	511.14	681.52	851.90
3	20.41	40.82	61.22	81.63	102.04	204.08	306.12	408.16	510.20	612.24	816.33	1020.41
3 1/2	23.85	47.71	71.56	95.41	119.27	238.53	357.80	477.06	596.33	715.60	954.13	1192.66
4	27.20	54.39	81.59	108.79	135.98	271.97	407.95	543.93	679.92	815.90	1087.87	1359.83
4 1/2	30.66	61.32	91.98	122.64	153.30	306.60	459.91	613.21	766.51	919.81	1226.41	1533.02
5	34.03	68.06	102.09	136.13	170.16	340.31	510.47	680.63	850.79	1020.94	1361.26	1701.57
5 1/2	37.46	74.93	112.39	149.86	187.32	374.64	561.96	749.28	936.60	1123.92	1498.56	1873.20
6	40.88	81.76	122.64	163.52	204.40	408.81	613.21	817.61	1022.01	1226.42	1635.22	2044.03
7	47.62	95.24	142.86	190.48	238.10	476.19	714.29	952.38	1190.48	1428.57	1904.76	2380.95
8	54.39	108.79	163.18	217.57	271.97	543.93	815.90	1087.87	1359.83	1631.80	2175.73	2719.67
9	59.10	118.18	177.27	236.36	295.45	590.91	886.36	1181.82	1477.27	1772.73	2363.64	2954.55
10	68.06	136.13	204.19	272.25	340.31	680.63	1020.94	1361.26	1701.57	2041.88	2722.51	3403.14
11	73.86	147.73	221.59	295.45	369.32	738.64	1107.95	1477.27	1846.59	2215.91	2954.55	3693.18
12	81.76	163.52	245.28	327.04	408.81	817.61	1226.42	1635.22	2044.03	2452.83	3270.44	4088.05
13	88.44	176.87	265.31	353.74	442.18	884.35	1326.53	1768.71	2210.88	2653.06	3537.41	4421.77
14	95.59	191.18	286.76	382.35	477.94	955.88	1433.82	1911.76	2387.71	2867.65	3823.53	4779.41
15	102.36	204.72	307.09	409.45	511.81	1023.62	1535.43	2047.24	2559.06	3070.87	4094.49	5118.11
16	109.24	218.49	327.73	436.97	546.22	1092.44	1638.66	2184.87	2731.09	3277.31	4369.75	5462.18
17	116.07	232.14	348.21	464.29	580.36	1160.71	1741.07	2321.43	2901.79	3482.14	4642.86	5803.57
18	122.64	245.28	367.92	490.57	613.21	1226.42	1839.62	2452.83	3066.04	3679.25	4905.66	6132.08
19	129.35	258.71	388.06	517.41	646.77	1293.53	1940.30	2587.06	3233.83	3880.60	5174.13	6467.66
20	136.13	272.25	408.38	544.50	680.63	1361.26	2041.88	2722.51	3403.14	4083.77	5445.02	6808.28
21	143.01	286.03	429.04	572.06	715.07	1430.14	2145.21	2860.29	3575.36	4290.43	5720.57	7150.72
22	149.77	299.54	449.31	599.08	748.85	1497.70	2246.54	2995.39	3744.24	4493.09	5990.78	7488.48
23	156.63	313.25	469.88	626.51	783.13	1566.27	2349.40	3132.53	3915.66	4698.80	6265.06	7831.33
24	163.32	326.63	489.95	653.27	816.58	1633.17	2449.75	3266.33	4082.91	4899.50	6532.66	8165.83

*Time is based on common feed of 0.001 inch per revolution and cutting speed of 50 feet per minute.

Note: In the figures given, the following allowances have been included: Delays, 10 per cent; tool grinding, 10 per cent; measuring, 5 per cent; and other essential interruptions, 5 per cent, making a total of 30 per cent.

per cut given in this table is based upon a convenient speed and feed, selected to provide a means of tabulating the data for a range of machining conditions. In using this table for estimating the time required for any particular job, the figures given in the table must be modified to suit the speeds and feeds actually used in the operation, as will be shown.

In making the calculations for a table of this type, allowance must be made for the time required to sharpen tools, measure the work, etc., and for other unavoidable delays and interruptions. On lathe work, this allowance may be taken as 30 per cent, giving a delay allowance factor of 1.30. Then, in determining the time required per cut, the length of cut is multiplied by the delay allowance factor, and this product is divided by the product of the selected speed in revolutions per minute times the selected feed in inches per revolution.

For example, since Table 1 is set up on the basis of a cutting speed of 50 feet per minute, a feed of 0.001 inch per revolution, and a delay allowance of 30 per cent, the charted time required to make a cut 20 inches long on work 6 inches in diameter would be:

$$\frac{20 \times 1.30}{31.8 \times 0.001} = 817.6 \text{ minutes}$$

In this formula, 31.8 equals the spindle speed

in revolutions per minute for a cutting speed of 50 feet per minute on a 6-inch diameter.

To convert the basic time shown in Table 1 to the estimated time for a particular job where speeds and feeds are used that differ from those selected in setting up the table, the tabulated time is multiplied by conversion factors obtained as follows:

Speed conversion factor = Speed used in setting up table divided by speed actually used for a given job

Feed conversion factor = Feed used in setting up table divided by feed actually used for a given job

These conversion factors may be tabulated, together with recommended speeds and feeds, as shown in Table 2. In this way, the estimator will have data on recommended machining practice available for quick reference, as well as conversion factors for use in connection with Table 1. The speeds and feeds given in Table 2 for various materials and set-up conditions were based on the use of high-speed steel tools, and were selected to suit average shop conditions. They are somewhat lower than the speeds and feeds ordinarily used.

In setting up tables such as this, an estimator should base them on some suitable length of tool life, and he should consider the equipment and facilities of his own shop, so that the tabulated

Table 2. Turning Speeds and Feeds with Estimating Time Conversion Factors

Material	Set-Up Condition	Depth Of Cut, Inches	Speeds, Feet Per Minute	Speed Conversion Factors*	Feeds, Inches Per Revolution	Feed Conversion Factors*
<i>Cast Iron</i>						
Hard	All Set-ups	1/16-1/8	40-50	1.250-1.000	0.020-0.030	0.050-0.033
Medium Soft	Rigid Set-up	3/32-5/32	70-90	0.714-0.555	0.040-0.060	0.025-0.017
Medium Soft	Strong Set-up	1/8-3/16	70-80	0.714-0.625	0.025-0.040	0.040-0.025
Medium Soft	Weak Set-up	1/16-1/8	60-70	0.833-0.714	0.020-0.030	0.050-0.033
Soft	Rigid Set-up	1/8-3/16	80-100	0.625-0.500	0.050-0.070	0.020-0.014
Soft	Strong Set-up	3/32-5/32	75-90	0.667-0.555	0.030-0.050	0.033-0.020
Soft	Weak Set-up	1/16-1/8	70-80	0.714-0.625	0.025-0.040	0.040-0.025
Finishing	All Set-ups	1/64	50-110	1.000-0.454	0.005-0.015	0.200-0.067
<i>Steel</i>						
Hot-Rolled Machinery	Rigid Set-up	1/8-1/4	100-125	0.500-0.400	0.030-0.050	0.033-0.020
Hot-Rolled Machinery	Springy Set-up	1/16-3/16	90-110	0.555-0.454	0.015-0.030	0.067-0.033
Cold-Rolled, Low Carbon....	Rigid Set-up	1/8-1/4	100-115	0.500-0.436	0.030-0.050	0.033-0.020
Cold-Rolled, Low Carbon....	Springy Set-up	1/16-3/16	90-110	0.555-0.454	0.015-0.030	0.067-0.033
Castings, Carbon	Rigid Set-up	1/8-3/16	50-60	1.000-0.833	0.020-0.040	0.050-0.025
Castings, Carbon	Springy Set-up	1/16-1/8	40-50	1.250-1.000	0.010-0.025	0.100-0.040
Alloy, Free-Machining	Rigid Set-up	1/8-3/16	70-80	0.714-0.625	0.020-0.035	0.050-0.029
Alloy, Free-Machining	Springy Set-up	1/16-5/32	60-70	0.833-0.714	0.010-0.025	0.100-0.040
Alloy, Tough-Machining....	Rigid Set-up	1/16-3/16	50-60	1.000-0.833	0.015-0.030	0.067-0.033
Alloy, Tough-Machining....	Springy Set-up	1/16-7/8	30-40	1.667-1.250	0.010-0.025	0.100-0.040
Unannealed Tool Steel	All Set-ups	1/16-1/8	40-50	1.250-1.000	0.010-0.025	0.100-0.040
Finishing	All Set-ups	0.005-0.010	50-125	1.000-0.400
<i>Non-Ferrous</i>						
Brass and Medium Bronze..	Rigid Set-up	1/8-1/4	125-150	0.400-0.333	0.030-0.060	0.033-0.017
Brass and Medium Bronze..	Springy Set-up	1/16-3/16	100-150	0.500-0.333	0.015-0.030	0.067-0.033
Bronze, Manganese	Rigid Set-up	1/8-3/16	80-100	0.625-0.500	0.020-0.040	0.050-0.025
Bronze, Manganese	Springy Set-up	1/16-3/16	60-80	0.714-0.625	0.010-0.025	0.100-0.040
Aluminum	All Set-ups	1/16-1/4	300-400	0.167-0.125	0.005-0.010	0.200-0.100
Finishing	All Set-ups	0.005-0.010	80-400	0.625-0.125	0.005-0.010	0.200-0.100

*These conversion factors are used with the tabulated data given in Table 1 to convert charted time to actual time based upon the use of recommended speeds and feeds.

data conforms to the particular operating conditions of that shop.

It should also be noted that the speeds given in Table 2 can be increased by approximately 30 per cent when coolants are used, and they can be increased by as much as 400 to 500 per cent when carbide-tipped tools are employed. Thus several tables of this type might be made in order to facilitate the estimating of lathe work under various conditions, particularly in view of the fact that such lathe operations as turning, facing, drilling, reaming, boring, threading, etc., require a wide range of speeds and feeds.

For example, a time chart, such as Table 1, for drilling or boring operations would give hole or bore diameter instead of outside diameter of work, and depth of hole or length of bore instead of length of cut. The tabulated time for these operations would be obtained in the same manner as the basic time given in Table 1 for turning operations, although delay allowances would vary, as would other considerations well known to shop men.

In setting up such a table for estimating the time required for threading operations, the same general procedure can be followed, although a different range of work diameters may be desirable. In this case, the time would be that required for one pass, or cut, with a single-point tool, and after conversion to actual estimated time, this figure would be multiplied by the number of passes required by recommended practice.

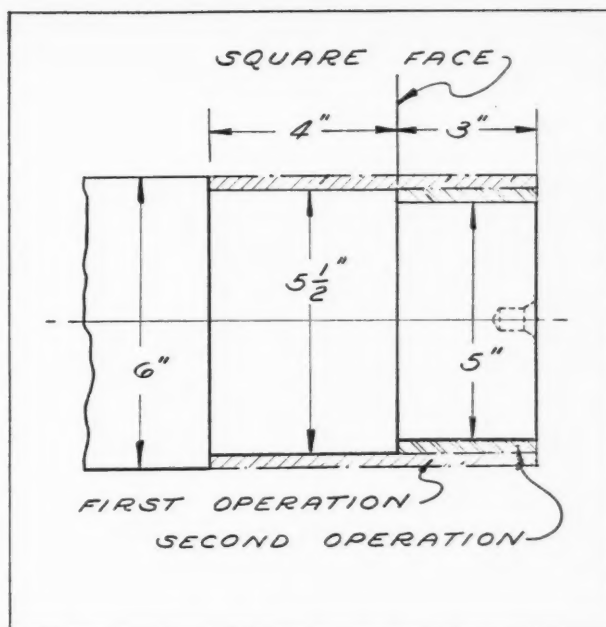
A table of conversion factors for use with the time chart would provide a means of reducing the charted time to actual estimated time for turning any number of threads per inch at any recommended cutting speed. To make up a conversion factor table such as this, it would first be necessary to change threads per inch to feed in inches per revolution. This can be done by applying the formula:

$$\text{Feed} = \frac{1}{\text{Threads per inch}}$$

The feeds thus obtained for any desired range of threads per inch would be divided into the basic feed used in setting up the time chart, as previously explained, thereby establishing the feed conversion factors. Speed conversion factors are, of course, obtained in a similar manner.

As an example of the application of Table 1 to threading operations, assume that a 1/2-13 thread is to be turned on a bar for a length of 3 inches. Referring to Table 1, the time for cutting a thread 1/2 inch in diameter for a distance of 3 inches is 10.21 minutes.

Converting threads per inch into inches per revolution, we have:



Part used as an example in describing application of tables set up for estimating time required for typical lathe operations

$$\text{Feed} = 1 \div 13 = 0.077 \text{ inch per revolution}$$

As the table is based on a feed of 0.001 inch and a speed of 50 feet per minute, the conversion factors would be obtained as follows:

$$\text{Feed conversion factor} = 0.001 \div 0.077 = 0.013$$

Assuming a cutting speed of 20 feet per minute, the speed conversion factor would be $50 \div 20 = 2.5$.

The time given in Table 1 for this cut is then multiplied by these conversion factors to obtain the actual estimated time for one pass, as follows:

$$10.21 \times 0.013 \times 2.5 = 0.3 \text{ minute}$$

Table 1 can also be used for estimating the time required for facing operations, the length of cut in this case being the width of face to be cut. Since the actual cutting speed decreases as the tool moves toward the center of the work, the largest diameter of the face is usually taken as the diameter to be used in selecting the estimated time from the table. If this surface is extremely wide, it is more accurate to select a mean diameter for estimating purposes, and then take half the difference between the mean diameter and the largest diameter as the length of cut. To the time given in Table 1 for this length of cut based on the mean diameter must be added the time for a cut of the same length based on the large diameter.

For example, if a flange 20 inches in diameter were to be faced and this diameter is taken for estimating, the length of cut would be 10 inches. Table 1 shows 1361.26 minutes for this cut. On

the other hand, if a mean diameter of 10 inches were chosen, the length of cut would be 5 inches, and the time (from Table 1) would be 340.31 minutes. To this is added the time taken from Table 1 for a 20-inch diameter work-piece and a cut 5 inches long, which is 680.63. Then the total time for the cut would be:

$$340.31 + 680.63 = 1020.94 \text{ minutes}$$

A simple example of the application of Tables 1 and 2 for estimating the time required to perform typical lathe operations follows: Two steps are to be turned on a 6-inch diameter brass bar, as indicated in the drawing, with a high-speed steel tool. One step is to be 5 inches in diameter, 3 inches long from the end of the bar, and the second step is to be 5 1/2 inches in diameter, 4 inches long from the end of the first step. The face of the second step is to be finished square with the axis of the bar. A rigid set-up is obtained by using a chuck for holding the work and supporting it at the tailstock end with a center.

Assuming that it is most practical to turn the larger step first, the initial operation consists of reducing the 6-inch diameter bar to 5 1/2 inches for a length of 7 inches. This can be done by taking a roughing cut over the 7-inch length, followed by a finishing cut for 4 inches after the second step has been produced.

As shown in Table 2, a depth of cut of 1/4 inch can be used on this stock. Thus, the roughing cut may be 0.240 inch deep and the finishing cut 0.010 inch deep. The speed and feed given in the table are 150 feet per minute and 0.060 inch per revolution, respectively.

As Table 1 does not show the time required for a cut 7 inches long, it is necessary to multiply the time given for a 1-inch cut on 6-inch diameter work by 7, or $40.88 \times 7 = 286.16$. The same result is obtained by adding together the time given for cuts 5 inches and 2 inches in length: Thus $204.40 + 81.76 = 286.16$. Multiplying this figure by the conversion factors given in Table 2 for the speed and feed actually used, we get the estimated time for the roughing cut as follows:

$$286.16 \times 0.333 \times 0.017 = 1.62 \text{ minutes}$$

The same general procedure is followed in estimating the time needed to produce the smaller step. In this operation, the 5 1/2-inch diameter is reduced to 5 inches for a length of 3 inches. Again, a roughing cut 0.240 inch deep can be taken, followed by a finishing cut 0.010 inch deep. The same speed and feed and the same conversion factors would be used in estimating the rough-turning time for this diameter. Then, referring to Table 1, the time for a cut 3 inches long on work 5 1/2 inches in diameter is found

to be 112.39 minutes. Multiplying this figure by the speed and feed conversion factors, the estimated time for the roughing cut on this diameter will be:

$$112.39 \times 0.333 \times 0.017 = 0.63 \text{ minute}$$

The 0.010-inch finishing cut is now made on the 5 1/2-inch diameter step for a length of 4 inches. Referring to Table 2, a speed of 400 feet per minute and a feed of 0.010 inch per revolution can be used for this operation, and the conversion factors are 0.125 and 0.100, respectively. Table 1 shows that 149.86 minutes are required for this cut; again, multiplying by the conversion factors, the estimated time for finishing this step is:

$$149.86 \times 0.125 \times 0.100 = 1.87 \text{ minutes}$$

To finish the 3-inch long, 5-inch diameter step with a 0.010-inch depth of cut, requires a speed and feed identical to that used for the finishing cut just described, and the same conversion factors are therefore used. The basic time given in Table 1 for this cut is 102.09 minutes; multiplying this figure by the conversion factors, the estimated time for finishing the 5-inch diameter step is found to be:

$$102.09 \times 0.125 \times 0.100 = 1.27 \text{ minutes}$$

Assuming that the removal of 0.010 inch of stock is sufficient to square the face of the 5 1/2-inch diameter step, it will be seen from Table 2 that a facing cut of this depth can be made at a speed of 400 feet per minute and a feed of 0.010 inch per revolution. Since the width of the face is small, 5 1/2 inches can be taken as the diameter of the work and the length of cut amounts to one-half the difference in the diameters of the two steps, or 1/4 inch. The time for this cut would be 1/4 the time given in Table 1 for a 1-inch length of cut on work 5 1/2 inches in diameter, or $37.46 \div 4 = 9.36$ minutes. As the conversion factors in this case are, again, 0.125 and 0.100, the estimated time for the facing cut is:

$$9.36 \times 0.125 \times 0.100 = 0.12 \text{ minute}$$

Disregarding handling, set-up time, etc., the estimated machining time for this job can be summarized as follows:

	Minutes
Rough-turning the 6-inch diameter to 5 1/2 inches for a length of 7 inches...	1.62
Rough-turning the 5 1/2-inch diameter to 5 inches for a length of 3 inches.....	0.63
Finish-turning the 5 1/2-inch diameter step to size for a length of 4 inches....	1.87
Finish-turning the 5-inch diameter step to size for a length of 3 inches.....	1.27
Facing the 5 1/2-inch diameter step.....	0.12
Total	(approx.) 5 1/2

The time given in the foregoing is for one cut only in each case. If more than one roughing, finishing, or facing cut were required for any of these operations, or if other lathe operations such as drilling, boring, threading, etc., were necessary, the time for each cut would be estimated in the same way, and the time for all the cuts would be added together to determine the total machining time for each piece of work.

* * *

Blanking and Piercing Small Lots by Low-Cost Methods

(Continued from page 143)

thus holding both the fixture and the blank in the desired position during the piercing operation. As the ram of the press rises, die *E* forces the blank, fixture, and stripper plate upward, thus piercing the hole, as seen at the right. The slug falls down chute *H*. When the ram descends, stripper plate *G* sheds the blank from the piercing punch through the action of stripper pins *J*.

At the completion of the work cycle, the magnetizing current is automatically interrupted, releasing the piercing fixture and blank. If another hole of different size is to be pierced in the blank, the fixture and blank are transferred to an adjacent press and the operation is repeated.

Since the work cycle is automatic, the press can generally be operated at maximum speed, which varies from 200 to 300 strokes per minute. The production depends upon the time required to place the fixture and blank in the working position, as the time taken in piercing is only a small per cent of the total time.

With this equipment, holes can be satisfactorily pierced in blanks varying in thickness from 0.005 to 3/8 inch. It is not uncommon to group as many as six presses in a semicircle for piercing six different sized holes in the same blank. This method has proved much more economical than building even the simplest type of die for piercing all holes in one press, particularly when only small quantities of the pierced blanks are required.

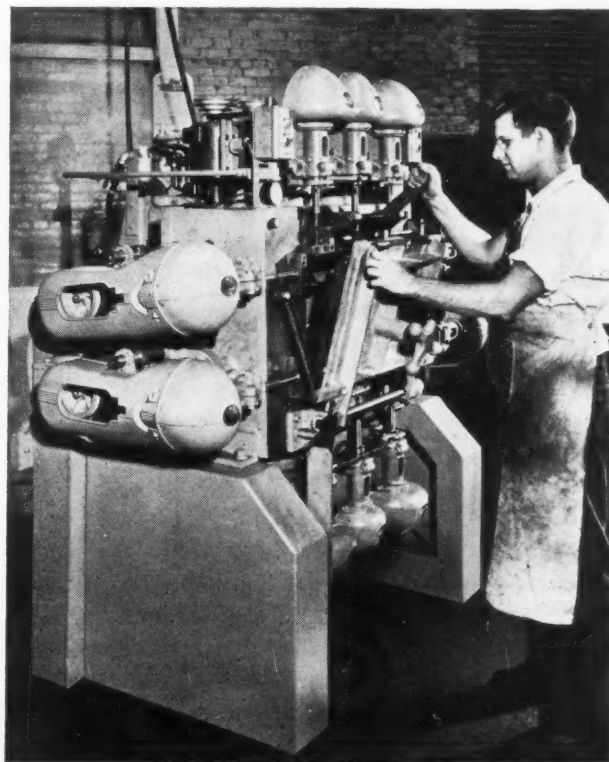
The methods described in the foregoing are patented developments of the Dayton Rogers Mfg. Co., but are available under a licensing agreement to companies concerned with the economical production of die-cut metal stampings in small lots.

* * *

Since 1914, the United States has been the largest producer and consumer of tin plate.

Special Machine Reduces Cost of Drilling a Saw Table

Recently the engineering department of the Delta Mfg. Division, Rockwell Mfg. Co., Milwaukee, Wis., was confronted with the problem of machining a casting for the table of a new tilting-arbor saw. This casting was scheduled for a substantial production program, and required the drilling of a total of eighteen holes on its four sides and bottom. The engineering department made a comparison of the costs of three different methods of handling this operation. The first two involved the use of machine



Special machine using Delta units arranged for drilling saw table castings

tools and a series of jigs, which would mean several handlings of the casting. In the third method, a special single-purpose machine was utilized, together with standard Delta units and other standard mechanisms, as shown in the accompanying illustration.

While the last-mentioned method called for a somewhat greater initial equipment cost, it reduced the labor cost for the initial run from 14 and 18 cents to 5 cents per casting. The machine used is completely automatic, requiring only loading and the pressing of a button to start the cycle. Aside from the labor saving involved, the use of this machine enabled the regular machine tools that would have been needed for this operation to be employed in machining other parts.

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Free-Machining Bronze Alloy Containing Lead but No Zinc

A bronze alloy that has a high lead content, but is made without zinc, has been announced recently by the Riverside Metal Co., Riverside, N. J. This alloy, known as "Mixture 44," is said to have a machinability of 90 per cent compared to the best free-cutting brass rating of 100 per cent or a Grade B1 phosphor-bronze rating of 50 per cent. Because of its high lead content, this alloy can be machined to closer tolerances at higher cutting speeds without burning or scoring the cutters. It is also valuable for applications where zinc cannot be used. The alloy is commercially available in the form of rods, sheets, strips, and bars.201

Tenite Employed for Portable Conveyor Rollers

Light-weight, tough Tenite plastic—a product of the Tennessee Eastman Corporation, Kingsport, Tenn.—is being used for the rollers on a portable Alvey-St. Louis conveyor with an aluminum or magnesium frame. The conveyor, designed for loading and unloading cartons from trucks, and for interdepartmental handling of cartons, is made in sections of 10 feet, each weighing only 31 pounds, and with a distributed load capacity of 500 pounds per 10-foot section. The Tenite rollers replace steel tubing and skate wheels for this application. The plastic rollers are resilient, have high impact strength, are resistant to outdoor exposure and dirt, and are corrosion-proof. The rolling performance of these rollers is said to be exceptionally good..202

Heavy-Duty Paint with High Aluminum Content

Speco, Inc., Cleveland 9, Ohio, has placed on the market a heavy-duty aluminum anti-rust paint, which utilizes a recently developed aluminum paste, said to be especially bright and long lasting. Its aluminum content is approximately double that of most aluminum paints.

This paint, called "Rustrem Super Aluminum," can be applied directly over rust without wire-brushing or scraping. It penetrates and seals the surface, preventing further rust action.....203

Carbon-Graphite Material Developed for Bearings

A carbon-graphite material, designated Purebon No. 5, that possesses outstanding characteristics for use as bearings has been developed recently by the Pure Carbon Co., St. Marys, Pa. It is composed of extremely fine, well-bonded particles, making it highly resistant to wear and abrasion. In addition, this material is non-toxic, does not rub off and discolor material with which it comes in contact, and can be used dry up to certain limits of speed and loading without undue wear of the bearing or of the metal shaft. It does not melt, seize, or change its shape when subjected to high temperature, and is unaffected by most strong acids, alkalies, or other corrosive liquids.

This new material can be molded to size on very small bearings, and on larger sizes it can be molded to approximate size and finished by machining or grinding to close tolerances. . .204

Chemical Surface Treatment for Aluminum, Steel, and Zinc

Enthone, Inc., 442 Elm St., New Haven, Conn., has announced the development of a compound, known as "Surprep," for cleaning surfaces prior to organic finishing. This product is a liquid containing oil-displacing chemicals that dislodge oil, grease, and other organic material from the surface of metals, so that they can be rinsed off with water or wiped off with a cloth. The compound also contains chemicals that dissolve rust, oxide, and scale.

The surface to which "Surprep" is applied is given a uniform etch. A light phosphate film is deposited, which gives an excellent base for the paint or organic finish, resulting in greatly increased bond strength. No toxic vapors are evolved during the use of the cleaner.205

New Lubricant for Pressure Die-Casting Dies

Scoring and sticking of pressure die-casting dies are prevented by a lubricant known as "Die Slick No. 9," which also enables easy ejection of castings from the die. This lubricant is produced by G. W. Smith & Sons, Inc., 5400 Kemp Road, Dayton 3, Ohio.

Applied with a brush or spray, as required, the new lubricant will not stain the casting and assures a good surface finish. This compound leaves no carbon, gum, or other residue in the die, and therefore eliminates the necessity of frequent die cleaning. It has been found of particular value in the manufacture of zinc-alloy castings that are to be plated, such as automotive hardware.206

Hammer-Effect Finish Obtained in Single Coat

The Brooklyn Varnish Mfg. Co., 50 Jay St., Brooklyn 1, N. Y., has announced a hammer-effect finish called "Tuf-On Hammer-Namel." This finish is applied in one coat to provide a smooth hammer-tone finish which resists abrasion and is not easily marred. It is suitable for covering imperfections on metal surfaces. The finish is baked on for twenty minutes.207

Spray Booth Compound with Non-Foaming Characteristics

A non-foaming water-wash spray booth compound has recently been developed by the DuBois Co., Cincinnati 3, Ohio. Because of its non-foaming characteristics, higher concentrations can

be used, which, in turn, keeps the hydraulic system of the spray booth absolutely clean. This material, designated "Differentiated Klarifiant," is recommended for use in the newer down-draft booths, where even the slightest amount of foam is objectionable.208

Elgin Diamond Compound for Lapping and Polishing

The Elgin National Watch Co., Aurora, Ill., has recently introduced to the industrial market a diamond compound known as "Dymo," which is said to offer important advantages in lapping and polishing operations. Among these are resistance to caking or drying out; permanent, uniform suspension of diamond abrasive particles; and stability at temperatures as high as 150 degrees F. It is available in the complete range of Bureau of Standards abrasive grades. An identifying color system simplifies selection.209

Cleaning Compound Developed for Aluminum Stampings

A cleaning bath, known as "Alkalume No. 1," which is effective on aluminum parts that are heavily coated with polishing composition, especially in recessed areas, has been announced by Northwest Chemical Co., 9310 Roselawn Ave., Detroit 4, Mich. Complete removal of the soil is accomplished without scrubbing by immersing the work in the bath for a period of from two to five minutes at 160 to 190 degrees F., depending upon the transfer time, followed by a thorough rinse of the free-flowing or spray type. The compound may be used in manual or automatic equipment where cleaning is by immersion.210

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on these pages, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in January, 1950, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
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Fill in your name and address on the blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

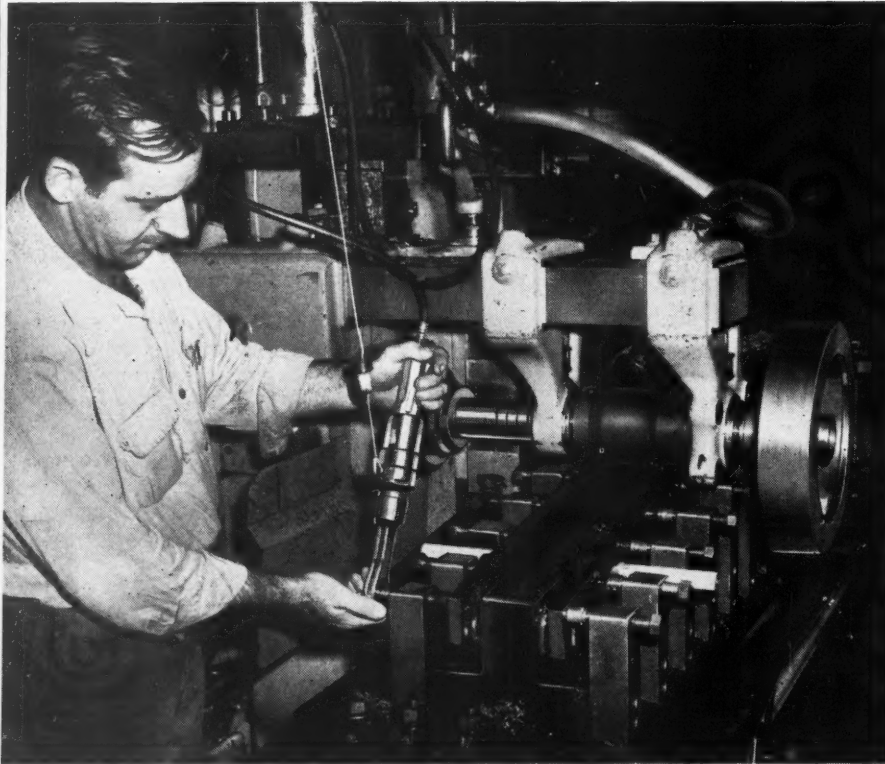
NAME..... POSITION OR TITLE.....
[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

CITY.....STATE.....

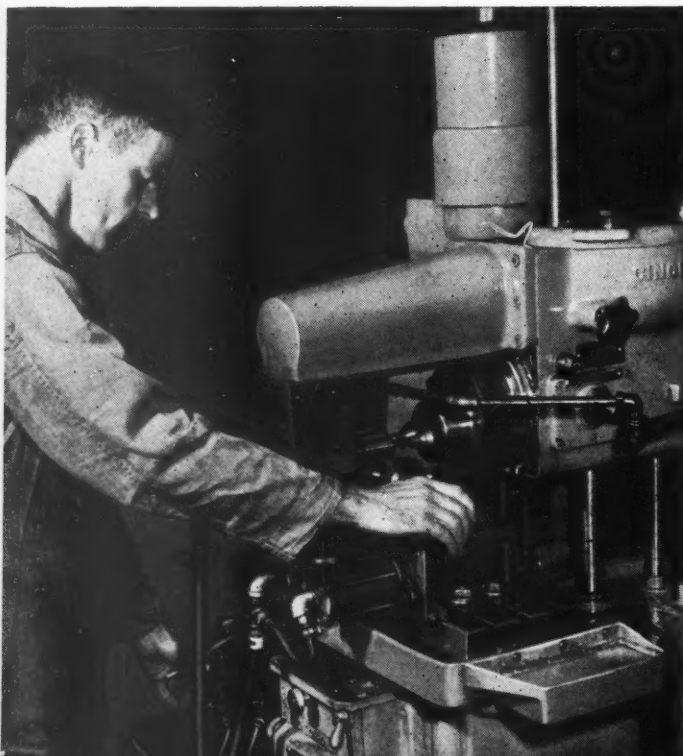
Air-Operated Tools and Fixtures Speed Production Operations



Milling operations on cutter-bars of a chain saw made by the McCulloch Motors Corporation, Los Angeles, Calif., are facilitated by the use of air-operated impact wrenches. Some of the fixtures used have as many as thirty bolts to tighten, and since the average machining time is fifteen minutes, considerable time and man power are saved by the use of pneumatic tools

Air-operated work-clamping fixtures are used in milling keyways in the crankshafts of light-weight gasoline engines at the McCulloch Motors plant, with a resulting high rate of production. The use of these fixtures enables one operator to attend two machines

Other air-operated equipment utilized in this plant to facilitate production includes pneumatic screwdrivers, nut-setters, etc. Because of the high speed at which the air motors rotate, extensive use is made of these tools in assembly operations on small gasoline engines



Selecting Anti-Friction Bearings for Machine Tools*

By JOHN H. BANINGER, Assistant Chief Engineer
New Departure Division, General Motors Corporation, Bristol, Conn.

TODAY machine tools are being built for higher speeds and are required to work to closer tolerances than ever before. In order to use these increased speeds and yet conserve the life of the cutting tools, it has become necessary to incorporate in machine tools a higher degree of precision and rigidity. Revolving parts must be so mounted that the highest working speeds can be maintained without excessive heating and without affecting the accuracy of the bearings. Since the duty demanded of bearings in this kind of service is so exacting, it is important to select the type of anti-friction bearing that will best fulfill the requirements.

The three principal types of anti-friction bearings are ball bearings (radial and angular-contact types), straight roller bearings, and tapered roller bearings. The advantages of each type depend mostly on the speeds at which they operate and the loads they have to carry without generating too much heat. For slow speed and heavy radial loads, the roller types are generally used, while for very high speeds and utmost accuracy or for heavy thrust loads, ball bearings are customarily preferred.

Spindle bearings must resist dual loads in any combination with minimum variation in efficiency and deflection, for in a machine tool spindle the radial and thrust components may vary in relation to each other over a wide range of load combinations. Abundant load capacity for all contingencies is a necessity, for it must be possible to work the machine to its full rated capacity without jeopardizing the efficiency or life of the bearings.

Also, the bearings must provide permanently a high degree of rigidity under all loads and speeds, for this quality affects not only the accuracy and finish of the work, but the life of the cutting tools and the machine as well. The spindle of a heavy-duty machine tool, if mounted on ball bearings, must be somewhat heavier than if supported by roller bearings, in order to obtain the same rigidity and consequent accuracy of the work. For the roller-bearing mounting, however, the radial load is not evenly distributed

over the full length of the rollers under spindle deflection, with the result that the load is concentrated on a reduced area. This not only increases the pressure per unit area, but also generates more friction and heat.

Recommended Installations for Spindles and Shafts

The use of three bearings for supporting a spindle or shaft should be avoided if possible, mainly because of the difficulty in maintaining alignment resulting from distortion of a housing not having uniform cross-section; trouble from localized heating; or difficulty in fastening the housing to the base. An exception is the case where an extremely long-quill construction is used.

Bearings with a large number of balls have less radial deflection under the same load than bearings of the same outside diameter with fewer balls of larger size. For spindle mountings, bearings of small cross-section are preferable to those of larger cross-section, with larger balls, as a stiffer spindle can be used.

For a high-speed shaft on which a heavy thrust load is imposed, the bearing selected for resisting the thrust should be mounted, if possible, at the end of the shaft. This permits the selection of a size of the heavy series having a bore smaller than the shaft without sacrificing shaft stiffness, thereby keeping the manufacturing cost low.

Bearings for Heavy-Duty Spindles

For rigid and accurate spindle mountings, the duplex type of bearing is most widely used because it is easier to produce two single bearings accurately than a double-row bearing. A duplex bearing has other advantages over a double-row bearing. It can be preloaded much more heavily because the preload is applied after the pair or set is mounted on the spindle and installed in its housing.

When preload is being applied, the outer rings of a duplex bearing will expand a small amount and take up the clearance provided for easy assembly in the housing. Thus, a metal-to-metal

*Abstract of a paper presented before the annual meeting of the American Society of Mechanical Engineers.

contact between the outside diameter of the bearing and the housing is obtained. This is necessary not only to secure the required spindle rigidity, but also to maintain the shape of the bearing outer rings and distribute the pressure more uniformly on the balls, thus maintaining the rated load capacity.

Duplex bearings are made to five different specifications, with various contact angles. The preload is specified by the customer to meet his operating conditions in the simplest and most suitable manner. Since these bearings are matched in pairs or sets not only for preload, but also for uniform bore and outside diameter, they should be kept together and installed that way. For precision units, it is also recommended that customers install the bearings with the high spot of ring eccentricity and run-out in alignment, thereby keeping bearing temperature and vibration to a minimum. The high spot of eccentricity usually is etched on the ring face with a burnished mark about 1/16 inch in diameter, and a check mark is employed to indicate face run-out.

For certain installations subjected to severe intermittent thrust and radial pressure from the cutting tools, the spindle nose can be supported advantageously by using a pair of duplex bearings having different contact angles, to obtain more uniform spindle rigidity. Since the axial pressure from the cutting tool is usually in the direction toward the headstock, the spindle-nose front bearing should have a higher contact angle than its mate. Thus the outside pressure required to relieve the back bearing of some of its preload will be considerably higher.

A flange type bearing for spindle-nose support is being adopted more frequently, as it permits the use of a straight-through hole in the headstock. Such a hole is much easier to machine and inspect, and can be obtained at considerably lower cost, which compensates for the higher cost of a bearing of this type.

It is common practice to support the main spindle for a heavy-duty machine tool with a pair of duplex bearings at the front and a slightly preloaded double-row bearing at the rear. The outer ring of the latter bearing should be mounted in a sleeve with a light interference fit to give the bearing the required support, while the sleeve itself should be installed in the housing with a sliding fit to prevent imposing a preload between the two spindle bearings and placing additional strains on the spindle. The sleeve should be interlocked radially with the housing to prevent creeping or revolving, thus eliminating wear between the two surfaces and curtailment of bearing life.

The use of a straight roller bearing for spindle rear-end support also has proved very satisfactory because the bearing outer ring can be installed with a light press fit directly in the housing, and the inner ring mounted with a heavy interference fit on the spindle to take up the bearing internal looseness and give the spindle rigid radial support. In the event that the axial expansion of spindle and headstock casting varies, no thrust load can be imposed on the bearings, nor any undue strains transferred to the spindle, as the straight rollers permit independent axial movement of inner and outer rings without affecting the performance of the bearing or the machine. To take up the radial looseness of such a bearing during installation without damaging the raceways, a bearing having a tapered bore would solve the problem.

Past experience has taught machine tool manufacturers to use anti-friction bearings of standard design and over-all dimensions, so they can be obtained from more than one source.

Bearings for Light-Duty Spindles Operating at Moderate Speeds

It is recommended that light-duty spindles operating at moderate speeds be supported on only two bearings, preferably of the extra light series. This will permit using a larger, stiffer spindle. A flange type angular-contact bearing at the front end, opposed to one of the same size at the rear end of the spindle, but without a flange (using spacers for preloading and installed in a headstock housing having a straight-through bore), has been adopted quite extensively because of satisfactory performance. Such a construction has the advantage of being rather low cost. From the service standpoint, also, it is attractive, as all the parts are easily accessible, since the drive is attached at the spindle rear end.

Bearings for High-Speed Spindles

Ball bearings have proved to be the most satisfactory type for high-speed spindles mainly because they are not so sensitive as other types of bearings to the application of the essential preloads. Furthermore, ball bearings operating under such conditions rotate more freely, and therefore generate less heat, and their lubrication is not so troublesome. Provision should be made to maintain uniform preload should the spindle and housing expand unevenly due to heating up of the bearing. This can best be solved by using spring pressure for preload.

Since the life of high-speed bearings is limited, depending on uniform preload, accurate

alignment, and proper lubrication, it is recommended that the quill type of construction be used, which, from a replacement or service standpoint, permits very short interruption of machine operation, and consequently is very economical.

Bearings for Very High-Speed Spindles

For the last few years, considerable study and experimentation have been devoted to spindles operating at very high speeds. Since the centrifugal force of the balls must also be taken into consideration for bearing-load calculation, the required bearing size is determined by the bearing outer-ring ball track, while the bearing inner-ring ball track is relieved of some of its load. Obviously, all the parts for such spindles must be made as close as possible to zero tolerances, especially the revolving parts. Therefore, both from the engineering as well as the manufacturing standpoint, it is often advisable to dispense with the bearing inner rings and grind the inner ball tracks directly on the spindle.

The high-frequency motor has solved the drive for such high-speed spindles in a most satisfactory way, as the spindle itself can be built up as the motor armature and it can be kept rather short. By finishing the outside diameter of the spindle, including ball tracks and armature, between centers, it is possible to obtain an absolutely concentric and dynamically balanced spindle.

It is preferable that the bearing outer rings should be of the deep-groove type. In order to use a one-piece, phenolic ball separator and still be able to assemble the two bearings, the snap shoulder should be on the outside of the spindle ball tracks and not in the bearing outer rings. The two bearings must be spring preloaded, applying the pressure against the bearing outer ring.

The reason deep ball tracks are recommended in the outer rings is to take care of slight axial movement of the spindle when the centrifugal force of the balls forces them to leave the predetermined angle of contact created by the spring pressure and move closer to the bottom of the outer ball track. Experience has proved that, if the bearing outer rings do not respond promptly to the pressure created by the centrifugal force of the balls, the balls will contact the snap shoulder, when it is machined in the outer ring, resulting in bearing failure.

A few design suggestions for the application of anti-friction bearings follow:

Feed-Screws—For positioning feed-screws, which usually revolve very slowly but must be

held rigidly and accurately, a combination of a ball thrust bearing and an annular bearing has proved most satisfactory.

Drive-Gear Boxes and Feed Mechanisms—To obtain quiet, smoothly operating gear-boxes, the mounting of rather long shafts in a double-row bearing on one side and a single-row annular bearing on the opposite side has been found advantageous. The double-row bearing holds the shaft rigidly both in a radial and in a longitudinal direction. No bearing end-play adjustment is required, and thus, no additional strains are imposed on the gear-case and shaft.

Snap-Ring Bearings—The use of snap-ring bearings simplifies the assembly of shafts, reduces the machining cost of the housing, and permits straight-through boring.

Shielded and Sealed Bearings—From years of experience with shielded and sealed bearings installed in all kinds of instruments and machines, enough information has been obtained to determine fairly accurately their useful life. Such grease-lubricated bearings are being rapidly adopted because no provision is necessary to lubricate them and they are protected adequately from contamination by foreign matter, not only during their installation period, but also in actual service.

Bearings for Pulleys—Loose pulleys, clutch pulleys, belt-tightener pulleys, intermediate gears, change-gears, etc., can be successfully and economically mounted on one double-row bearing of the preloaded type.

Bearings for Rollers—The adoption of ball bearings as cam or guide rollers is recommended only for greatly reduced bearing ratings. Furthermore, if shielded or sealed type bearings are used for such service, their load should be reduced still further, thereby preventing the shields or seals from snapping out of the outer ring groove in which they are held. However, in emergencies, the outer rings can be reinforced considerably to sustain their rated load capacity. It should be noted that such a bearing is special, and is not desirable from a service standpoint, as it can be obtained from only one source at a prohibitive price.

Anti-Friction Bearing Slides—The introduction of anti-friction bearing slides for longitudinal tables, carriages, and cross-slides has been highly successful, tests conducted so far having fulfilled all expectations. However, in order to obtain rigid and accurate support by the use of such slides, whether horizontal or vertical, the balls must be inserted with a predetermined interference, so that each ball will be subjected to a uniform preload, regardless of the continuously moving weight they have to carry.

Questions and Answers

Liability for Patent Infringement

C. W. K.—If a manufacturer, seller, and user of a patented device infringe a valid patent, who is liable? In other words, which one of the three should the person who owns the patent sue for infringement?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

The manufacturer should be sued. In *Salem Engineering Co. vs. National Supply Co.* [75 Fed. Supp. 993], the patentee sued the purchaser of a patented machine for alleged infringement of the patent. The testimony showed that the latter had purchased the machine from its manufacturer. The Federal Court held that the suit should be brought against the manufacturer rather than against the user or purchaser. In some cases, however, the manufacturer, seller, and user may be jointly liable.

Warpage in Castings

E. S. S.—What composition would you suggest for high-speed machine tool cast-iron parts that must be highly accurate dimensionally and must not warp after finish-machining?

Answered by Reynolds Metals Co.
Louisville, Ky.

Our first choice would be Reynolds A-44 composition, which contains 0.3 to 3.30 per cent carbon; 1.40 to 1.80 per cent silicon; 0.50 to 0.80 per cent manganese; and 1.25 to 1.75 per cent nickel.

There is a chance that distortion in the castings will develop from locked-in stresses which become relieved in the course of time and lead to misalignment. In many cases, the alloyed irons are able, through the greater uniformity they produce in the structure, to eliminate the source of locked-in stresses, but in certain instances where high precision is essential, an additional stress-relieving heat-treatment may be necessary. If your equipment requires such high accuracy, you may find it desirable to stress-relieve all of the castings that are involved

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

by heating them to a temperature of 950 to 1050 degrees F. for at least one hour per inch of section and cooling them slowly.

If the alloy cast iron you are using at present is satisfactory in all respects except for the warpage after ma-

chining, we would suggest that you make a test upon some of the castings stress-relief-annealed as directed, to observe whether the difficulty has been eliminated. If it should persist, then look for some other factor as the source of misalignment; for example, it may be possible that there is an uneven thermal expansion in members of the assembled unit.

Simple Method of Testing Surface Finish

G. D. G.—In contract work, we are occasionally required to produce parts having a certain surface finish. Inasmuch as the quantities involved are small and these requirements need be met infrequently, we would like a description of a simple method of testing surface finish that does not require the use of expensive equipment.

A.—Of the various methods devised for checking or measuring surface irregularities, many are particularly suitable for shop work. One of the simplest and least expensive means by which this can be accomplished with sufficient accuracy for most classes of work consists of comparing, by means of touch, a machined surface with a standard finished sample or specimen. This can be done merely by dragging the fingernail first over the standard block and then across the "lay" or ridges of the machined surface. A table tennis ball may also serve as the contact point, and when used in conjunction with a stethoscope, provides a sensitive test for the smoother class of surfaces. In testing interior surfaces, or small holes, a pointed copper wire with a right-angle bend may be used.

When it is not convenient to obtain from a customer a sample having the desired finish, sets of standard surface specimens can be purchased. These sets consist of blocks having surfaces varying from the smoothest to the roughest likely to be required.

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Hydraulically Operated Double-Draw Die

By L. D. RICHARDS, Houston, Tex.

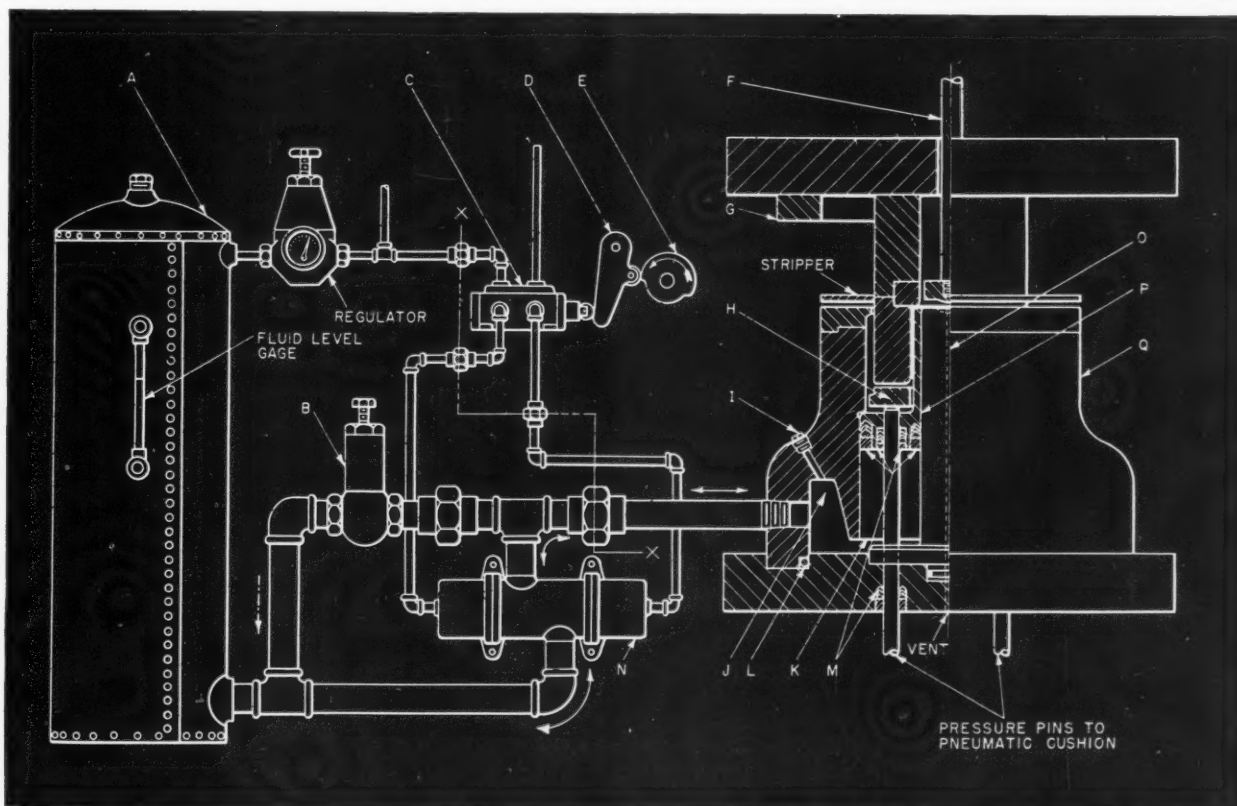
The hydraulically operated drawing die shown in the accompanying illustration was designed to complete, in one operation, a draw and a redraw required in the production of a 52S-O aluminum shell. Using material 0.032 inch thick, in coils, the shells are drawn to a depth of 3 3/8 inches, with an outside diameter of 2 inches.

The design combines a conventional compound blanking and drawing die having a scrap cutter with an ordinary sleeve type redraw die. The redraw sleeve *P* serves a dual purpose in that it also strips the part from the form block *O*. In the first drawing stage, sleeve *P* is held stationary and flush with the top of the form block. It is maintained in this position by an enclosed hydraulic system, timed by control valve *N* and

a four-way pilot valve *C*, which is actuated by cam *E* on the press crankshaft.

After sleeve *P* is raised to the top of the form block by oil flowing under pressure from hydro-pneumatic accumulator *A* through control valve *N* to the pressure chamber in the die, pilot valve *C* is actuated to close the control valve. This holds sleeve *P* stationary during the first draw, since the oil cannot pass back through the control valve nor can it go through safety valve *B* under ordinary pressure. At the instant the first draw is completed, which is the position shown, the pilot valve is actuated to open control valve *N*, releasing the oil, which then flows back through the control valve to the accumulator, and permits sleeve *P* to move down.

In the event of failure of either the pilot valve or the control valve, safety valve *B*, which is set to function under a safe tonnage load, opens to permit fluid from the pressure chamber to flow



Aluminum shells are drawn and redrawn in one operation in this hydraulically operated die

back to the accumulator. This eliminates the danger of damage to the die or press from built-up pressure.

As sleeve *P* moves downward under pressure regulated at the air entry of the accumulator, it serves to redraw the shell. At the end of the redrawing operation, on the upward stroke of the press ram, the sleeve strips the shell from the form block, after which it is ejected from the die by a knock-out *F* and blown onto a conveyor by an air jet.

The press is of the single-action type, equipped with an air cushion which supports a conventional pressure-plate *H* for the first drawing stage. As the pressure-plate and its support pins must continue downward after the first draw is completed, the air cylinder stroke is longer than would normally be used on this press.

Chevron packing *M* is installed around both the inside and outside of the sleeve at the base and also around each of the six pressure pins where they pass through the sleeve and the die-shoe. Hydraulic pressure is nominal throughout the cycle, due to the large area under the sleeve. Peak fluid velocity was calculated not to exceed 15 feet per second in any part of the system. The main control valve and fluid piping for this circuit is 1 1/2-inch nominal size. The hydro-pneumatic circuit operates at 40 to 60 pounds per square inch for the job described. Overheating of the fluid is eliminated by the large accumulator, which provides ample volume for the circuit.

Pilot valve *C* is mounted on the press frame directly under the crankshaft end, and is operated by a rocker-arm lifter *D* in combination with cam *E*. The rocker arm absorbs the lateral thrust that direct coupling would impose on the valve plunger, and also increases the valve lift per degree of cam rotation. The cam revolves in a one-to-one ratio relative to the crankshaft. The pilot valve is operated from the crankshaft instead of the ram because this makes it easier to provide ample open time for the control valve, thus insuring return of the sleeve under the low pressure of the hydro-pneumatic system. It is not desirable to close and open the control valve at the same point in the up and down strokes.

Since only about one-third of the available press time is required for this operation, the entire hydraulic system is mounted on a truck, by means of which it can be moved out of the way when not in use. Disconnecting the air-supply line coupling and four pipe unions, as shown by line *X-X*, separates the hydraulic unit from the press and die. No shut-off valves are included in the system, as these would cause damage if accidentally left closed. Inasmuch as

both the control valve and the safety valve are normally closed, there is only a small escape of oil when the system is disconnected. A gage glass on the accumulator indicates the desirable oil level at all times, and a filler plug permits easy replenishment.

Referring to the construction of the die, O-ring seals *L* are provided at the base of both the form block *O* and the main housing *Q*, where they are recessed into the die-shoe. Housing *Q* is a chromium-nickel casting. The annular opening *K* in the housing is of ample volume to permit free flow of oil between the pressure chamber and the integral flow chamber *J*, which is tapped to receive the piping. An air escape plug *I* is provided at the highest point in the flow chamber, which is also the highest point in the hydraulic system when sleeve *P* is at its bottom position. Care must be taken to see that the ram, together with the sleeve, is at the bottom of its stroke before the system is connected up. Air is turned on gradually until clear oil without bubbles escapes through plug *I*.

The knock-out *F* is operated by the knock-out bar in the press ram. The knock-out pad has a convex center that embosses the bottom of the cup, and an engraved insert that stamps the company name and address at the bottom of each draw. The scrap cutter *G* functions on each stroke, the scrap dropping down a chute into a wheeled container.

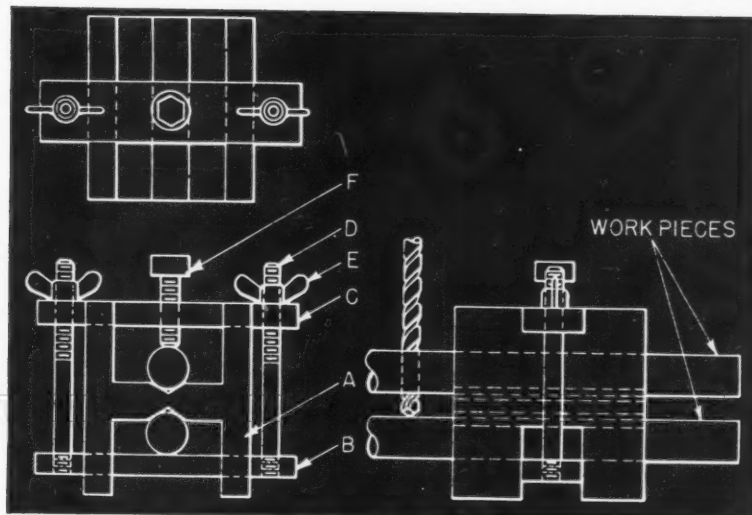
Stock feed is from front to back, and ejection of the drawn parts is from left to right. A motor-driven stock reel, which is stopped and started automatically by a photo-electric system, includes a drawing compound dip trough and an adjustable wiper. The press is fed manually and has a speed of thirty-four strokes per minute. Two operators are required, one feeding and controlling the press while the other watches such details as stock oiling, scrap clearance, air pressure, etc., and inspects the product visually.

V-Block Jig Simplifies Drilling of Aligned Holes

By H. MOORE, Kirkstall, Leeds, England

The special V-block shown in the accompanying illustration was constructed to facilitate the drilling of holes in pairs of rods, and is also useful when a drilled rod can be used as a jig for producing holes in another rod. One of the principal advantages of this device is the clamping arrangement, which provides for the tightening of each rod separately. By this means, the lower work-piece can be clamped securely while the

Special V-block jig which facilitates the drilling of holes in rods and shafts



rod in the upper vee is free for radial and axial alignment of the previously drilled holes. A pair of these blocks considerably facilitates the drilling of work of this type.

In making this V-block jig, part A is machined to an H-shape with a vee on each side of the cross-bar. Slots are cut through the top and bottom of the legs in the center, at right angles to the vees, the bottom slot being deep enough to allow the clamping strap B to slide up and down to suit various sizes of rods. The slot in the top is equal in depth to the thickness of strap C, which is a tight fit. Studs D connect the two straps, passing through clearance holes in strap C to engage tapped holes in strap B. Wing-nuts E on these studs tighten the clamping strap B against the work in the lower vee, and screw F clamps the rod in the upper vee.

When drilled holes in a rod or shaft are to be duplicated in another rod, the new part is placed on straps B of two of these blocks, and is clamped in the lower vees by means of the wing-nuts E. The rod in the upper vees is adjusted axially

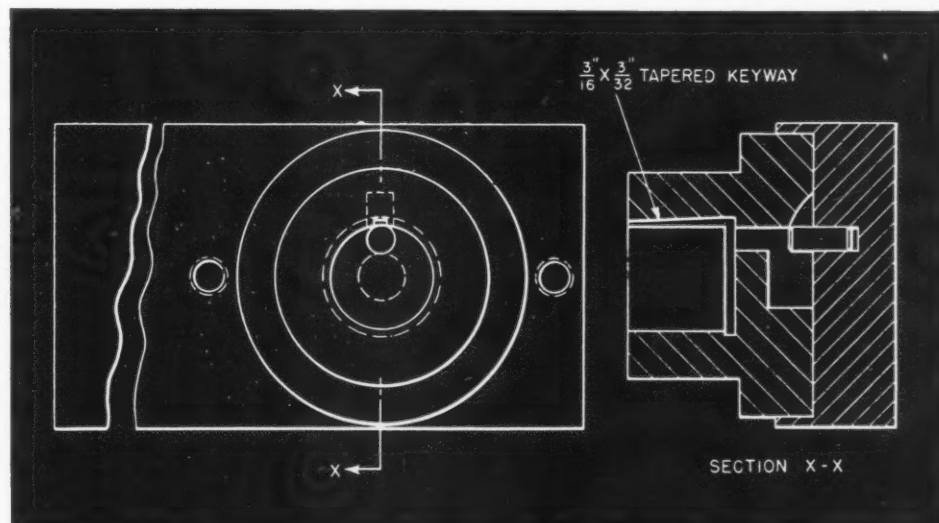
relative to one end of the new work-piece, and is also adjusted radially by running a drill in the machine spindle through one of the drilled holes. This rod is then tightened in place with screws F. In the case of a job where neither rod has been previously drilled, the same procedure is followed, except that the center-punch marks in the top rod must be positioned vertically.

Fixture for Machining Tapered Keyways on a Shaper

By L. L. WALKER, Seattle, Wash.

The difficulty of machining a tapered keyway in the cast-iron part seen in the accompanying illustration was considerably simplified by doing the job on a shaper with the fixture shown. The fixture was made from a piece of scrap steel 1 1/2 inches thick, 4 inches wide, and 20 inches long, and bored to suit the flange of the work. Close to the bored flange seat, two holes were

The tapered keyway in a cast-iron part was cut in a shaper by the use of the fixture here illustrated



tapped diametrically opposite each other for 1/2-inch diameter studs. A suitable clamping arrangement was used with these studs to hold the work in the fixture. As seen, a 5/16-inch diameter pin was driven into a drilled hole in the bottom of the bored seat. Projecting about 1/4 inch, this pin engages a slot in the work for locating purposes.

After clamping the fixture in the shaper vise, it was shimmed up at one end to obtain the angle of taper required in the keyway. A keyway cutter in the toolpost was moved up to the locating pin for central alignment, after which the tool was backed away and the work placed in the fixture. With this equipment, the keyways were machined in four minutes apiece.

Holding Guide Pins by Friction Eliminates Mechanical Fasteners

By L. KASPER, Philadelphia, Pa.

A method of holding guide pins in such a way that they can be conveniently turned or otherwise moved when worn is shown in the accompanying illustration. Strands of wire are guided into a wire processing machine by being passed between a series of pins. As wear of the guide pins takes place, it is necessary to turn them or move them axially. A form of frictional holding device was considered desirable, in order to perform this operation quickly and without stopping the machine. The design illustrated proved to be a satisfactory means of attaining this end.

The block *A*, which supports the guide pins *B*, is grooved lengthwise and drilled to receive the pins. A spring *C* is placed in the groove before the pins are inserted. The spring is of the open coil type and is wound with a pitch slightly less than the center distance between the pins. As the diameter of the spring is such that the spring extends slightly into the line of the pin holes, each pin, as it is placed in position, will spread

the coils of the spring slightly, which creates sufficient pressure on the pin to hold it securely in place and yet leave it free to be moved as required.

* * *

Bonding Aluminum to Steel for Protection against Corrosion

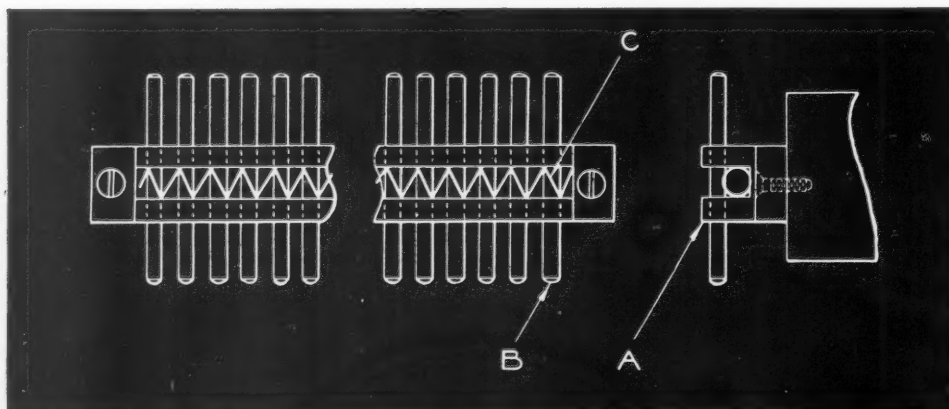
A new method of bonding aluminum to steel in order to protect the steel against corrosion has been patented by Richard S. Reynolds, president of the Reynolds Metals Co., Richmond, Va. In this method, two strips of aluminum foil are applied to the top and bottom of the steel sheet. Prior to the application of the aluminum, a fine iron coating is produced on the steel by an electrolytic process to provide a permanent bond between the steel and aluminum surfaces. The previous method of dipping the steel in molten aluminum resulted in an unsatisfactory bond.

The process consists of passing steel strip continuously from a coil through a cleansing bath to an electrolytic bath, where it receives the iron coating, and then to a furnace where it is heated to about 850 degrees F., after which it passes between two strips of aluminum foil, which are bonded to the steel by high-pressure rolling. The aluminum-covered steel can then be further rolled to reduce its thickness as desired.

* * *

Chromium Used in Steel Making

The United States acquires a little more than half of the total world chromium output, but produces normally less than 1 per cent. The principal use of chromium is as an alloy in making steel. More than 212,000,000 pounds of the metal were used for this purpose in American furnaces during 1948. Chromium is added to steel in the form of ferro-chromium, an iron-chromium alloy.



Holding guide pins by utilizing spring pressure eliminates mechanical fasteners, thus permitting rapid adjustment of the pins to compensate for wear

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER
Lester, Hankins & Silver
Sales Management Engineers
New York and Philadelphia

The 1950 Yardstick

IF we measure the frame of the kitchen window to replace a broken glass, do we argue with our yardstick? No. First we pick out a good yardstick, and then follow it right along. Every alert sales manager selects a yardstick for sales operations. Market possibilities should be evaluated and sales quotas set. Routes of travel may often be established, and the number of calls to be made determined upon. These all appear finally as marks on a piece of paper—desirable guides.

But what counts so much for the sales engineer is the kind of yardstick he, himself, selects and the way he uses it to measure performance and progress day by day. After all, our sales effort cannot be measured only in time and in miles. What we do in those moments—those hours—decides the results stacked up to our credit at the end of the year.

Pick out a Good Yardstick Now

Don't be satisfied simply with good intentions and fine resolutions—so common at the beginning of a new year. What kind of yardstick shall we use to measure our year-end results? Here are some of the marks on it that will help shape our work in 1950:

Our Attitude—Let's forget past irritations and sore spots. Capture a new and enthusiastic picture of the job. Selling is creative. Right now, it's the vital force in industry. It will create jobs—increase income and wealth. This attitude—this enthusiasm applied to every prospect, never letting down with disappointment or rebuff—eventually piles up business for us.

Time—Each of us is allowed about the same number of moments and hours in which to work. But measuring results by time is often meaningless. Every day we see one salesman achieve far

more than another simply by the application of "motion study" to selling and the perfection of technique. The result of a call upon a prospect is not measured in time, but in ideas presented, conviction established, and favorable decisions achieved. Salesmen lose an inordinate amount of time by failure to plan their travel routes and contracts, by disregard for the necessity of evaluating what is essential, and above all, by neglect to prepare for the critical moments spent with the prospect prior to a decision. Some salesmen don't take time out to review their failures, but blithely go on to the next prospect and commit the same errors.

New Friends—"One new friend a week, at least, I seek" is the way one clever machinery salesman expresses a mark on his selling yardstick. And he does not mean just an acquaintance; he means a person he has learned to know and to help—one who, in turn, will help him. He is the type of salesman who studies his prospects and studies himself. He knows that, in selling, business flows from establishing a two-way human path. He plans those moves necessary to develop friendship from acquaintanceship.

Helpful Suggestions—Selling machines is essentially a job of making someone's work easier. "The biggest kick of all," said one salesman, "is to see how some suggestion I made led to helping the prospect and to an order for one of my machines." It has been pointed out many times that, to be successful in selling, we must concentrate on the prospect and his problem rather than on what we sell, but this fact is repeatedly forgotten. Every man's work is a puzzle. We win by helping him solve his puzzle, not focussing on ours.

Clean up Details—There is a story about a Pennsylvania Dutch housewife, who, after a busy life lay on her death bed. Her five daughters

were gathered around to catch her parting words. "Girls," she whispered, "keep your griddles clean."

Just as the housewife can't make good hot cakes without a clean griddle, so the machinery salesman can't keep customers without clean handling of quotations and ordering. The 1950 yardstick clearly points out the necessity of cleaning up details promptly and thoroughly.

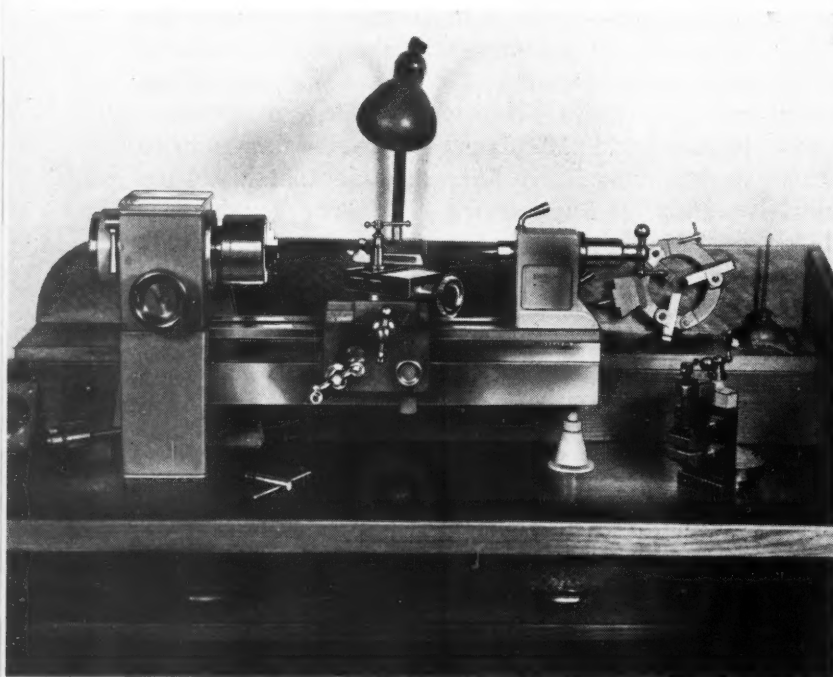
Selling Tools—One workman may forget a tool—even a yardstick. Another, perhaps, is negligent in using all the tools in his kit that are necessary for the job. Selling tools are resources. Repeatedly we find a salesman who wastes his time and that of his prospect because he forgets to have at hand sales tools consisting either of ideas in his head or literature and specific data.

A trusty yardstick never argues nor lies. It gives us a standard to work by in making our plans and evaluating success and failure. There never was a better time than the New Year to select a good yardstick and use every day.

* * *

Home Built Lathe Used in Making Precision Instruments and Models

The bench lathe shown in the accompanying illustration was designed and built as a spare-time project by Norman EnHolm, mechanical engineer and instrument maker, Lake Mahopac, N. Y. This interesting lathe was designed especially for use in making precision parts for motion picture cameras and for machining parts for models developed by the builder.



One of the most interesting features of this lathe is the drive, which includes a Vickers hydraulic transmission mounted below the bench and controlled by a dial shown at the extreme left. Spindle speeds ranging from 0 to 1100 R.P.M. in either direction can be obtained by adjusting the control dial.

The V-belt of the drive from the Vickers unit passes through the bench at the back of the headstock and is enclosed in a metal housing. The V-belt drives a jack-shaft in the headstock which, in turn, drives the spindle through helical gears of 1 1/2 to 1 ratio.

The spindle carries a sixty-tooth spur gear at the left end, which can be engaged by an arm that is pivoted in the housing and has five teeth of the same pitch, so arranged that it can be swung into mesh with the sixty-tooth gear to lock the spindle when changing chucks. This arrangement also serves as a dividing head, and is controlled by the handle shown at the upper left side of the headstock.

The polished handwheel in front of the headstock is mounted on the jack-shaft and has a graduated dial which can be used in performing indexing operations, since it is accurately synchronized with the spindle movement.

A small handwheel at the lower right-hand corner of the apron controls a finger that rides under the front edge of the bed and adds to the stability of the carriage. Fitted to the lathe are faceplates, a four-jaw chuck, and a milling attachment. The milling attachment is designed to be mounted on the cross-slide in place of the compound rest, and utilizes the same hold-down means as the latter unit. This results in an exceptionally rigid and accurate mounting for the milling attachment.

All bearings are of the large Timken taper roller type, and run in oil. The lathe swings work up to 6 5/8 inches in diameter, and holds pieces up to 13 inches long between centers. The parallelism of the spindle with respect to the bed is accurate within 0.0003 inch in 13 inches. All the parts were machined and precision ground from aged, heat-treated materials.

* * *

Studies by the U. S. Bureau of Standards show that the average car gets 21 miles per gallon at 20 miles an hour, 16 at 40 miles an hour, 11 at 60 miles an hour, and 8 at 80 miles an hour.

Precision bench lathe designed especially for use in fine instrument and model making

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Pratt & Whitney Giant Size Jig Borer

A huge vertical type jig borer capable of locating and boring precision work weighing up to 2 1/2 tons within accuracy limits of 0.0001 inch has just been announced by the Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford 1, Conn. This addition to the line of precision jig boring machines introduced by Pratt & Whitney in 1917 weighs 15 tons, and is known as the No. 4-E. Its open-side construction has been developed to provide maximum convenience in placing and holding a wide range of work.

The standard machine, shown in Fig. 1, has a 36- by 72-inch rectangular table with a longitudinal travel of 60 inches and a transverse travel of 36 inches. The maximum standard height from table top to spindle nose is 33 inches, but columns 6 inches, 10 inches, and 14 inches higher can be furnished. A combination rectangular and built-in 42-inch diameter rotary table or a built-in 48-inch rotary table can be furnished in place of the plain rectangular table.

Tools with shanks as large as No. 5 Morse taper are held in the spindle with collets and a spindle nose cap. The hardened, ground, and lapped quill is 5 1/2 inches in diameter, and has a 10-inch vertical travel with power feeds, both up and down, ranging from 0.0005 inch to 0.015 inch per revolution of the spindle. An adjustable dial indicator depth gage with positive stop is built into the spindle head for boring to exactly the desired depth.

Electrical controls are centered in a pendent control station (Fig. 2), located at the normal operating position. This control station is adjustable to suit operating conditions. Push-buttons and selector switches control spindle motor speed selector; spindle start,

stop, and reverse; spindle clutch and brake; vertical power movement and automatic clamping and unclamping of spindle head; longitudinal rapid power travel of table for quick positioning; and carriage and table power milling feed selector, which gives a full range of feeds, from 1 to 16 inches per minute.

In addition to the controls on the pendent box, push-buttons are also located on both carriage and table control brackets for chang-

ing rapid power travel when positioning work in both longitudinal and transverse directions. Since the new machine is much larger than the preceding Pratt & Whitney jig borers, it was found desirable to equip it with a new type P & W "Electrolimit" measuring system instead of the standard end-measuring system.

An electric control cabinet, located at the right of the machine, contains a main disconnect switch, all starters, relays, and electronic

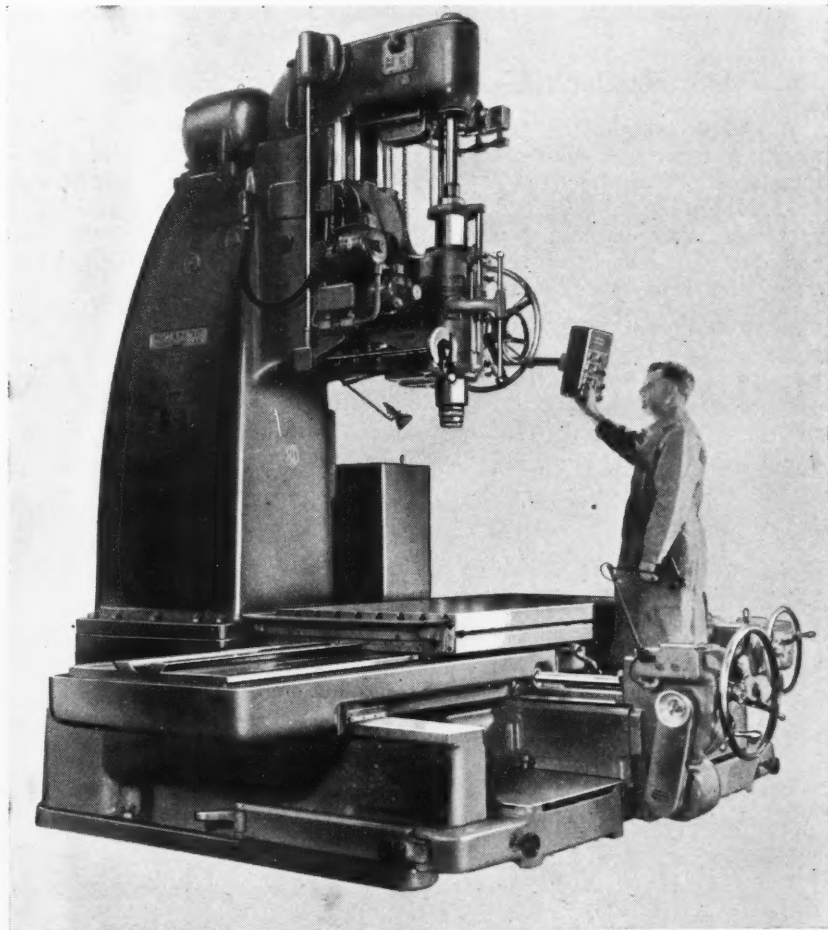


Fig. 1. Giant size jig boring machine of open-side construction recently announced by Pratt & Whitney

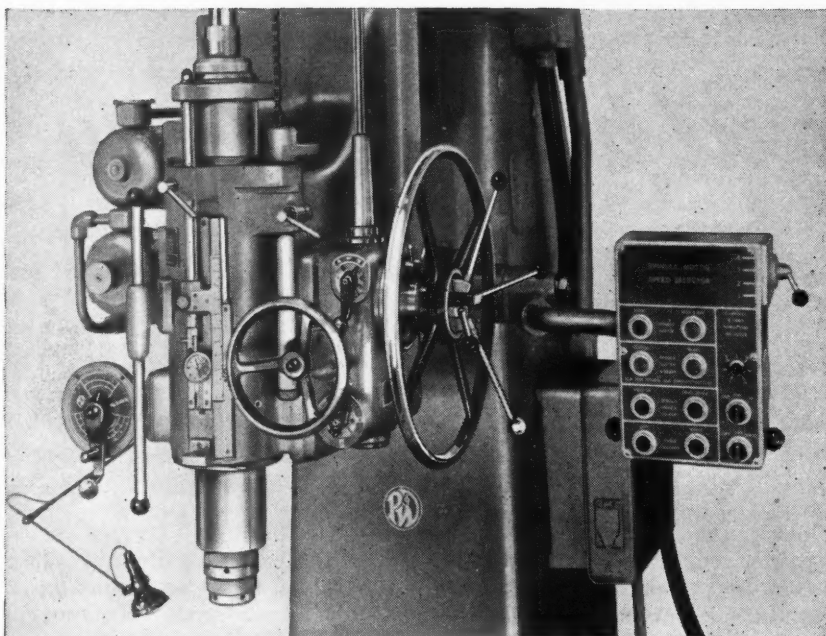


Fig. 2. Close-up view of spindle and pendent control station of Pratt & Whitney jig boring machine shown in Fig. 1

and other electrical apparatus necessary for the operation of the machine. This separate unit eliminates the possibility of heat transfer to the machine. The en-

tire machine and the control cabinet occupy a floor space approximately 12 1/2 feet wide by 11 feet deep. The height, with the highest column, is 12 feet.61

Double-Deck Six-Station Transfer Machine

A unique six-station transfer machine using a double-deck system, built by Greenlee Bros. & Co., 1872 Mason Ave., Rockford, Ill., performs sixty drilling, reaming, and tapping operations on the sides and ends of cylinder and valve housings. The part is first

loaded into the lower deck, where fifty drilling, reaming, and tapping operations are performed. It is then turned 90 degrees and placed in the upper deck for the ten remaining drilling and reaming operations.

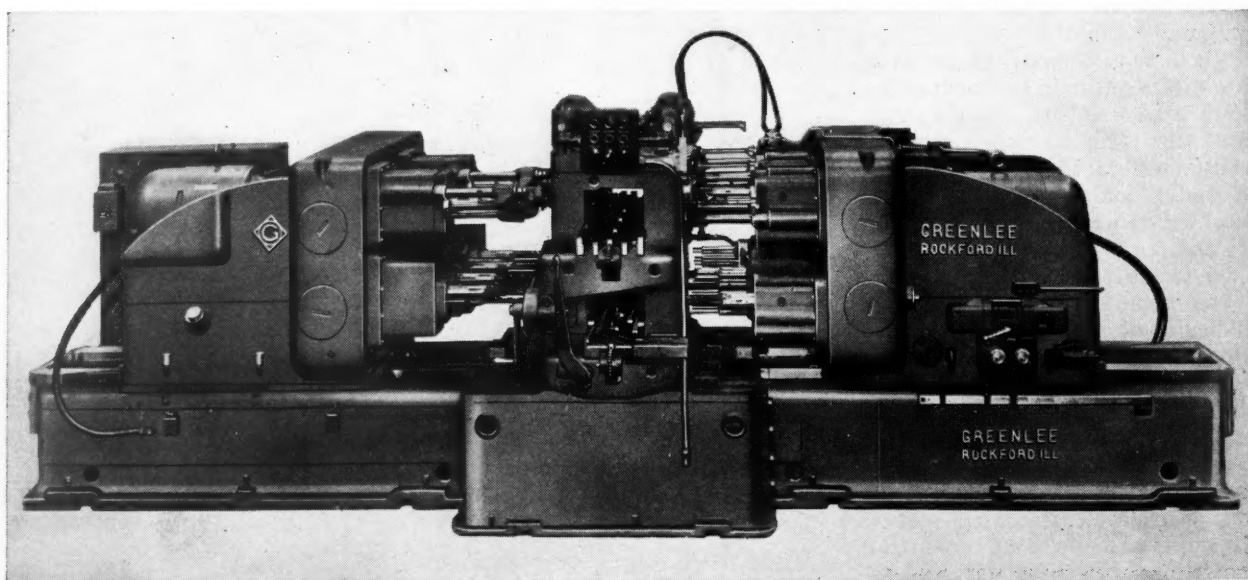
In order to maintain close tol-

erances during the machining operations, the parts are located in both decks by dowel-pins, and firmly held in pneumatically actuated wedge clamps. The workpieces are transferred manually from one station to another by a continuous chain system. A locking device makes indexing impossible until the heads have completed their operations.62

Westinghouse "Life-Line" Induction Motors

Alternating-current induction motors ranging from 20 to 75 H.P. are being produced at the Buffalo plant of the Westinghouse Electric Corporation, 306 Fourth Ave., Pittsburgh 30, Pa. The stator frames of these new "Life-Line" motors are rolled from heavy flat steel and welded into rings while on a mandrel. This produces stators having accurate, uniform inner diameters that will properly accommodate the stator laminations.

The brackets or end bells are drip-proof, the top half being solid while the lower half has ventilating openings. Both sleeve and ball-bearing brackets are available. The sleeve-bearing motors are of the Westinghouse sealed-sleeve type, with air bypass, and the ball-bearing motors are equipped with self-sealed pre-lubricated bearings. The new motors will be supplied in all standard ratings at 60, 50, and 25 cycles.63



Greenlee double-deck six-station transfer machine designed to perform sixty machining operations on the sides and ends of cylinder and valve housings

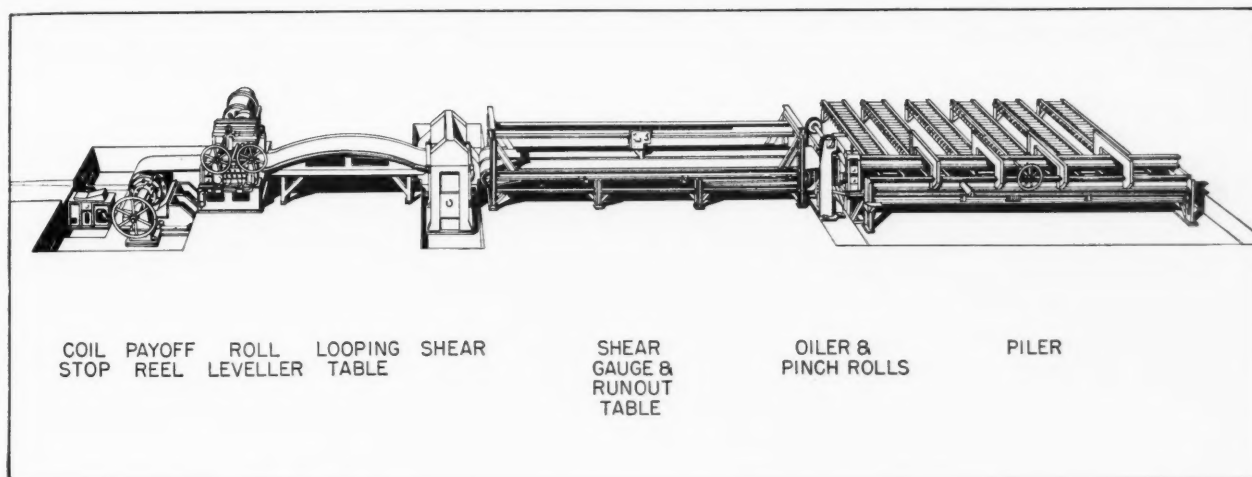


Fig. 1. New Bliss shear line for flattening and cutting coil stock

Bliss Shear Line for Flattening and Cutting Coil Stock to Length

Coil stock can be flattened and cut to any length at the rate of approximately 300 feet per minute on a new moderately priced shear line consisting of eight units arranged for continuous operation. This shear line, developed by the E. W. Bliss Co., Toledo 7, Ohio, is designed for moderate production in steel, brass, and copper mills, warehouses, and fabricating plants. The complete line, as indicated in Fig. 1, consists of a coil stop, pay-off reel, roll leveller (shown also in Fig. 2), looping table, up-cut shear, gage table and automatic gage unit, oiling unit and pinch rolls, and sheet piler.

The simplified up-cut shear (Fig. 3) has an extremely rigid, solid-slab, one-piece frame, bored to accommodate the self-aligning

type anti-friction bearings for the eccentric shaft. The lower knife head slides on flat bronze ways on the cutting (or knife) side of the head, and is backed up by a 45-degree bronze slide member on each side. This arrangement simplifies the problem of adjusting for wear in the slides, since only one adjustment compensates for both side and end wear.

The shear gage, hung on rollers from a beam located over the gage table, is moved to position manually for any length of cut and locked securely by means of wedge clamps and a handwheel. It consists essentially of a spring balanced stop-bar, mounted to sweep away from the end of the strip when being raised. This arrangement prevents damage to the cut end of the strip.

The gage-bar is raised through a toggle arrangement by a solenoid coil. It is positively locked in the gaging position by the toggle action, making it impossible for the strip to move the gage-bar and cause a mis-cut. Space is provided between sheets for dropping the gage-bar by running the shear exit conveyor approximately 10 per cent faster than the shear entry conveyor.

A time-saving feature of the line is the newly designed hydraulic piler, which consists of a platen mounted on two mechanically synchronized hydraulic cylinders. When the desired height of pile is reached, the piler is lowered to its extreme bottom position, allowing the platen to straddle permanently located gravity rollers. The pile is deposited on these rollers and automatically discharged under the side guides at the side of the piler. _____64

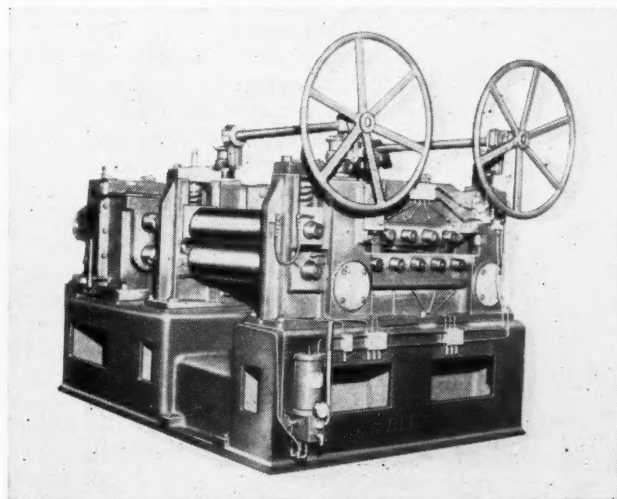


Fig. 2. Roll leveler of shear line shown in Fig. 1

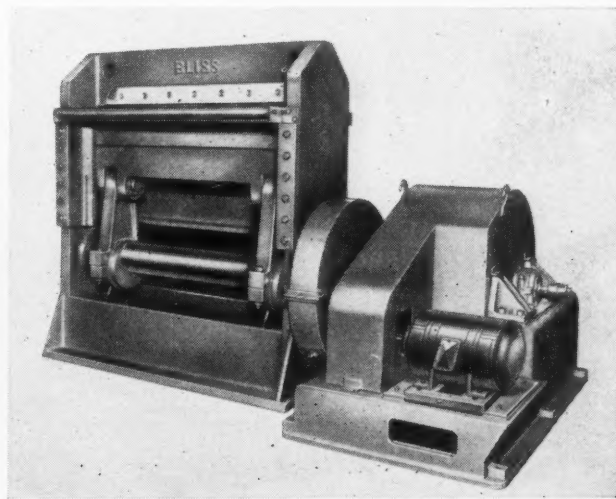
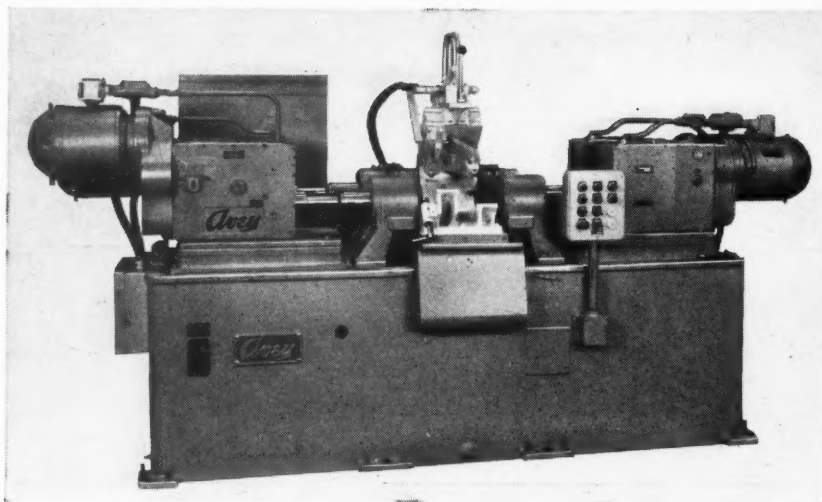


Fig. 3. Up-cut shear of the line shown in Fig. 1



Special boring machine equipped for operations on sewing machine parts brought out by Avey Drilling Machine Co.

Avey Special Boring Machine Equipped for Operation on Sewing Machine Arms

Both ends of sewing machine arms are rough- and finish-machined on a special boring machine brought out by the Avey Drilling Machine Co., Cincinnati 1, Ohio. The work is held on a two-position automatic hydraulic index table, mounted on the machine base.

Smooth cutting is assured by large roller-bearing housings at each station, which support the cutter adapters. The cutting tools are driven by four No. 2 Avey cam feed units in a specially arranged cycle that reduces idle time to a minimum.

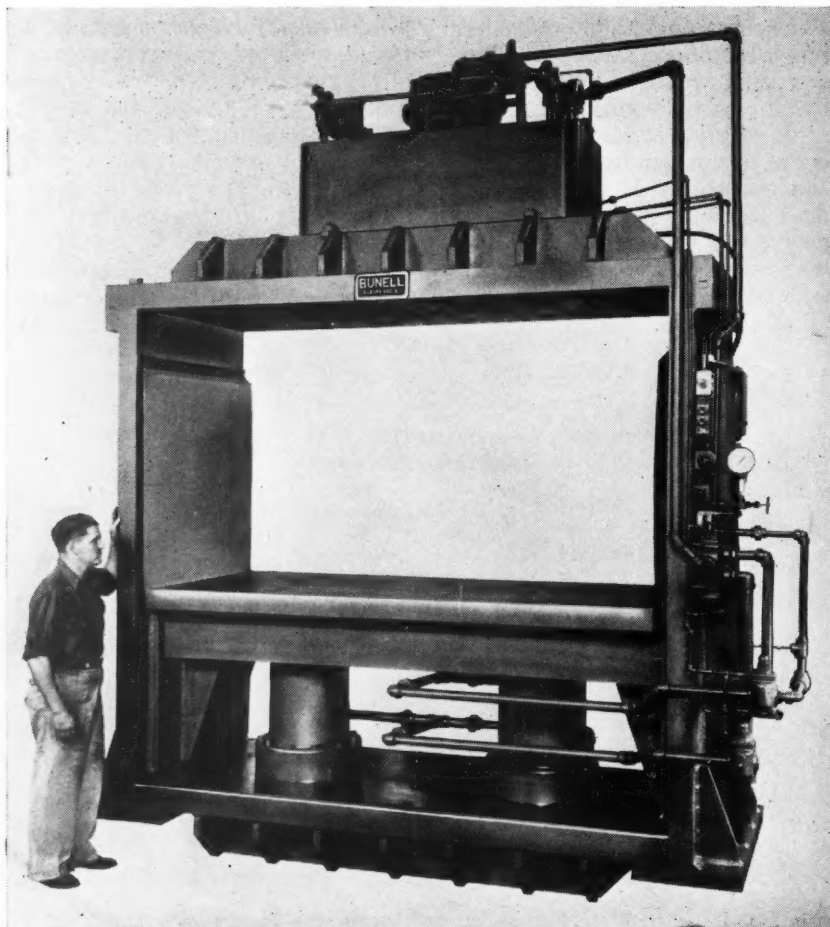
After the work has been hydraulically clamped, the right- and left-hand roughing cutters advance at a rapid rate to the cutting position, and then proceed to cut to the required depth at a predetermined rate of feed. The roughing spindles return at the rapid rate to their starting positions, after which the table is automatically indexed to the finishing position, and the tools at this station go through a similar cycle. The table then returns to the starting position, where the work is removed and replaced by a new piece.

The indexing table is designed with special automatic oiling facilities for lubricating the ways. A system of signal lights indicates when the units are in the proper position. Thus, if one of the units fails to function, the operator is notified by the lights, and the automatic cycles of the table and cam-feed units will not function until all difficulties have been corrected. 65

Bunell Universal Hydraulic Press

A universal hydraulic press, said to be of highly flexible design and low cost, has been brought out by the Bunell Machine & Tool Co., 1601 E. 23rd St., Cleveland 14, Ohio. The press can be supplied to meet individual specifications for die space, die opening, stroke, pressure, and number of hydraulic cylinders. It will handle such widely diversified work as die spotting and try-out, blank development, straightening, molding, laboratory testing, steel stamping, and assembling.

Very light or high pressure capacities can be built in to individual presses. Finger-tip control for regulating final pressure makes the press safer and easier to operate. Fast approach and slow movement of the ram for the last portion of the stroke are provided to allow better control and decrease the possibility of breaking the die. Two-way hydraulic cylinders permit the application of pressure in either direction of the ram movement. Controlled downward movement makes it possible to stop the ram at any desired working height. 66



Universal hydraulic press brought out by the Bunell Machine & Tool Co.

"Steelweld" Shear of Exceptional Length

The longest "Steelweld" shear ever built has just been completed by the Cleveland Crane & Engineering Co., 5430 E. 281st St., Wickliffe, Ohio. This machine has a capacity for shearing 18 feet of 3/16-inch mild steel at the rate of fifty strokes per minute. Like all Steelweld shears, it operates on the pivoted-blade principle. The blade travels in a circular path without the use of guides and slides such as are commonly used with guillotine type shears, thus eliminating difficulties from wear at these points.

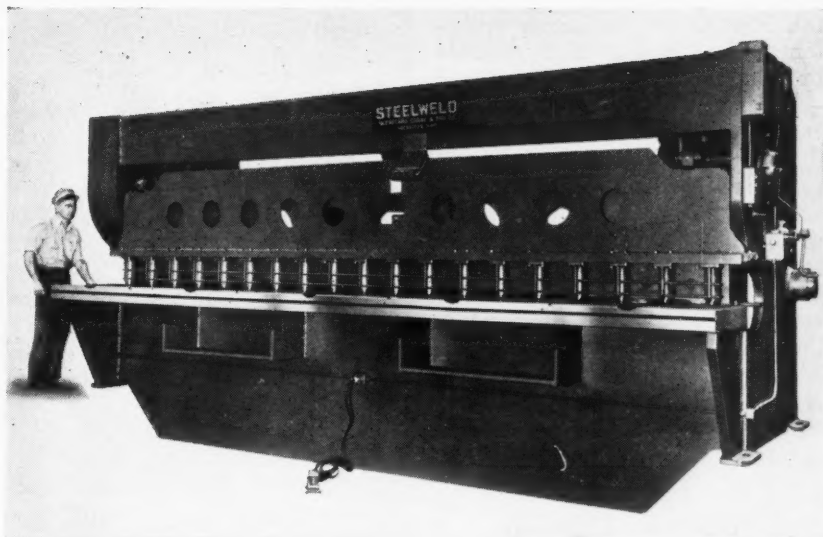
Ball-bearing transfers in the bed facilitate movement of the steel through the knives. A motor-operated back-gage, with slow and fast control buttons, makes it easy to position the material to be cut accurately. The back-gage indicator, reading in inches and 1/64 inch, can be readily seen through an oblong slot in the hold-down beam, so that there is no need for the operator to walk to the end or rear of the shear to make any necessary adjustments.

The shearing action is controlled by an electrically operated foot-switch, which can be located to suit the convenience of the operator. The knife clearance can be easily adjusted to suit the thickness of the plate being cut by simply turning a hand-crank and observing a large dial indicator.67

"Safco" All-Purpose Coolant Base

A water-soluble coolant base known as "Safco" 770 compound, which has the consistency of a liquid paste and is said to combine all the advantageous qualities of a grinding compound and a sulphurized cutting oil has been placed on the market by the Swan-Finch Oil Corporation, RCA Bldg. West, New York 20, N. Y.

When used in grinding operations and



"Steelweld" shear of unusual length built by Cleveland Crane & Engineering Co.

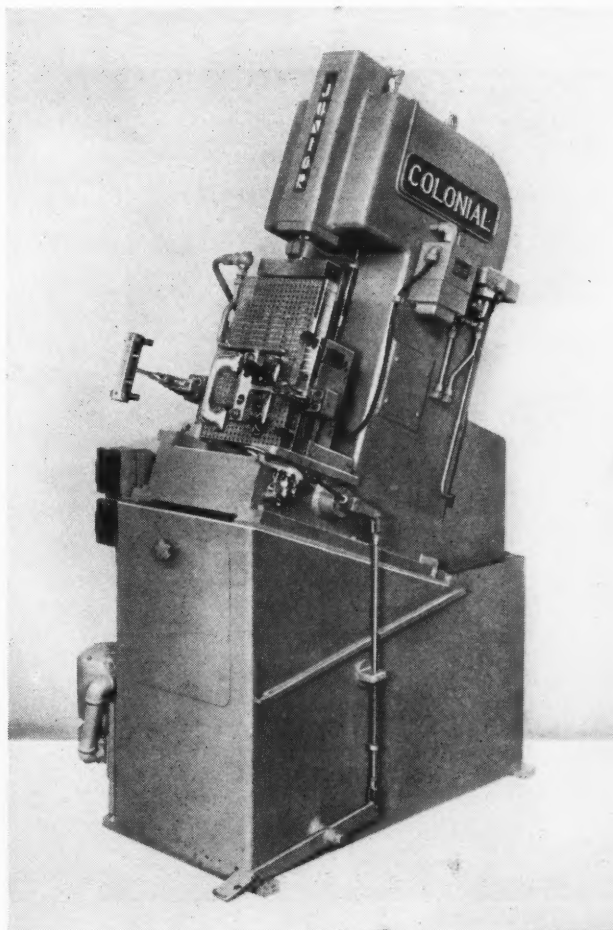
mixed with water in ratios as high as 80 to 1, this compound is claimed to prevent wheel-loading; reduce wheel-dressing; keep work from rusting; and keep solutions free from unpleasant odors.68

Colonial Broaching Machine Equipped to Machine Automotive Door Handles

Easier loading and an unusually high degree of operator safety are outstanding features of the

broaching set-up for rocker type automotive door handles recently developed by the Colonial Broach Co., Box 37, Harper Station, Detroit 13, Mich. This equipment consists of a standard bench type 2-ton hydraulic Colonial "Junior" press with a 12-inch stroke, mounted at an angle on a special fabricated base. A hinged guard screen covers the broaches during loading, as well as during the machine cycle, the work being inserted through holes in the screen.

The inclined position of the press facilitates loading, and also makes it possible to use the weight of the door handles to hold the parts in position until the quick-acting toggle clamps are swung into place. In addition to broaching two door handles at a time side by side, the set-up is such that both ends of



Colonial "Junior" press equipped for broaching automotive door handles

the handles are broached simultaneously. This is made possible by using separate sets of broaches—one above the other—for each end of each handle.

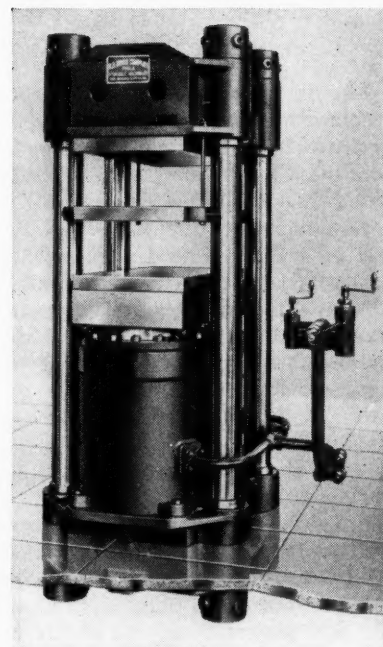
The coolant nozzles are semi-permanently attached to the guard screen and connected to the piping with a ball joint in line with the screen hinges. Thus the nozzles are always correctly positioned and yet can be swung back out of the way with the guard screen. An electrical interlock prevents return of the broaches to the starting position until the finished parts have been removed. 69

Jones & Lamson Hydraulic Bar-Feed and Collet-Chuck Mechanism

A bar-feed and collet-chuck mechanism that can be operated continuously at high production rates with minimum operator fatigue has been brought out by the Jones & Lamson Machine Co., Springfield, Vt., for use on Jones & Lamson Nos. 3, 4, 5, 7, and 8 universal turret lathes. A single-lever, finger-tip control of the complete operating cycle serves to increase production. 70

Multiple-Opening Steam Platen Press

The R. D. Wood Co., Public Ledger Building, Independence Square, Philadelphia 5, Pa., has recently developed a 750-ton capacity, two-opening platen press for molding and curing plastic and rubber products. The solid steel moving platen and two rolled firebox-steel steam-heating platens are 24 by 50 inches in size, and have a maximum deflection of only 0.005 inch under uniform loading. Accuracy is further insured by the carefully machined bearing surfaces and end supports of the four steel columns.



Steam platen press developed by the R. D. Wood Co.

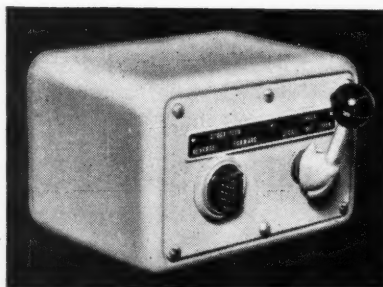


Fig. 2. Close-up view of control panel of hydraulically operated bar feed and collet chuck

This press is designed for operation with an accumulator system at 2000 pounds per square inch, and can, if desired, be supplied completely self-contained, with its own motorized pump and control equipment for installations

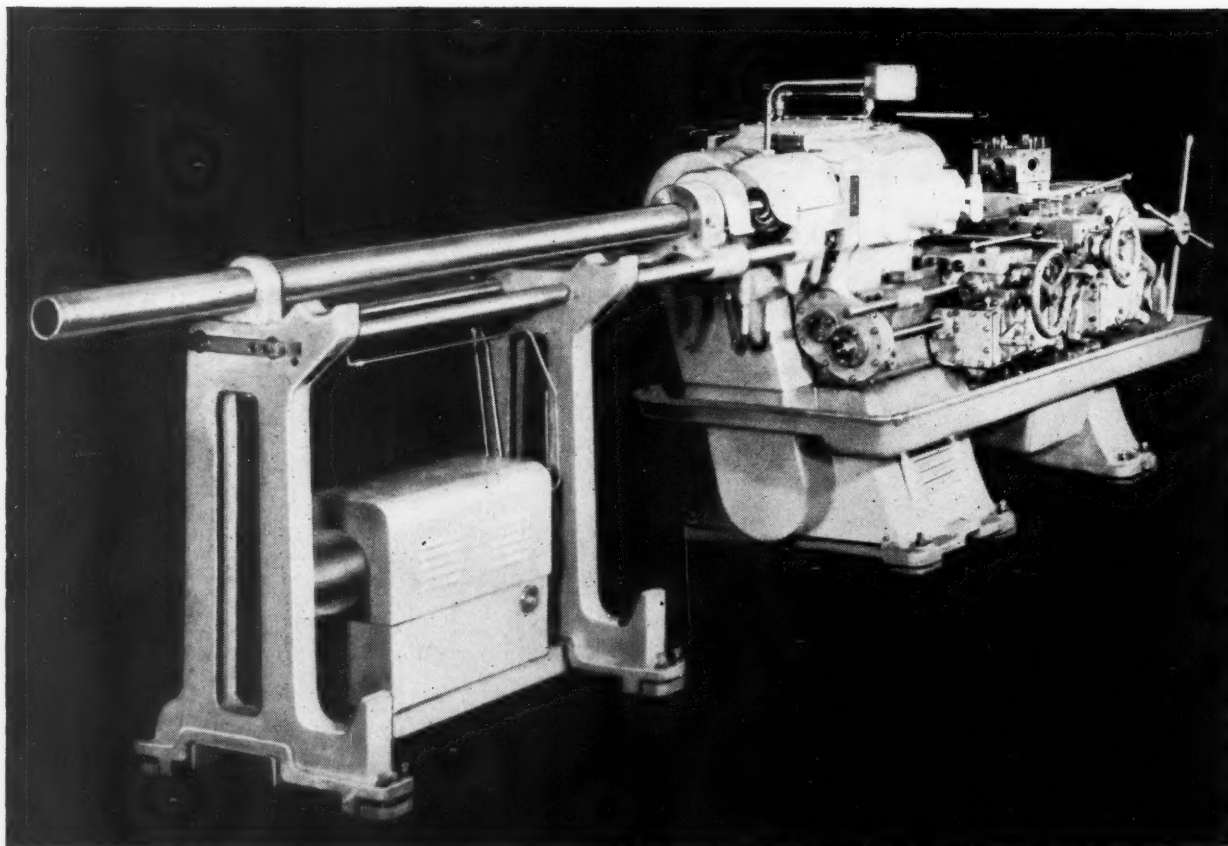
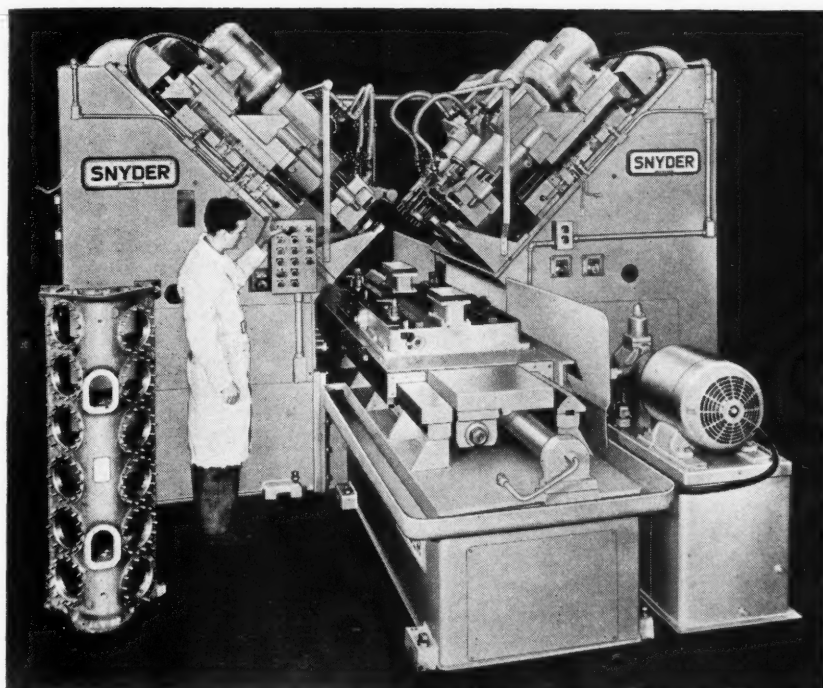


Fig. 1. Jones & Lamson ram type universal turret lathe equipped with hydraulic bar feed and collet chuck



Multiple-station line-indexing machine built by Snyder Tool & Engineering Co. for processing crankcases

without central hydraulic power. Push-down rams for speedier operation are available. The press can also be supplied in other sizes and capacities. _____ 71

Snyder Multiple-Station Crankcase Processing Machine

The Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich., has recently built an eleven-station, line-indexing, 90-degree V-type machine with hydraulic feed for processing large aluminum crankcases. After being loaded, this machine is entirely automatic in operation, and can be attended by an unskilled worker. Guide plates establish accurate positioning, and clamping is accomplished manually. A hydraulically actuated bolt is provided to position the index-slide before the heads begin the machining operations.

The machine has a welded steel bed with hardened and ground steel ways on which the hydraulic index-slide is mounted. On both sides of the bed are mounted angular, welded steel columns, each of which carries two counter-

weighted Snyder standard units. Each unit carries a fourteen-spindle head. The columns carry, in addition, two tapping units with two fourteen-spindle tapping heads having individual lead-screws. The part is automatically

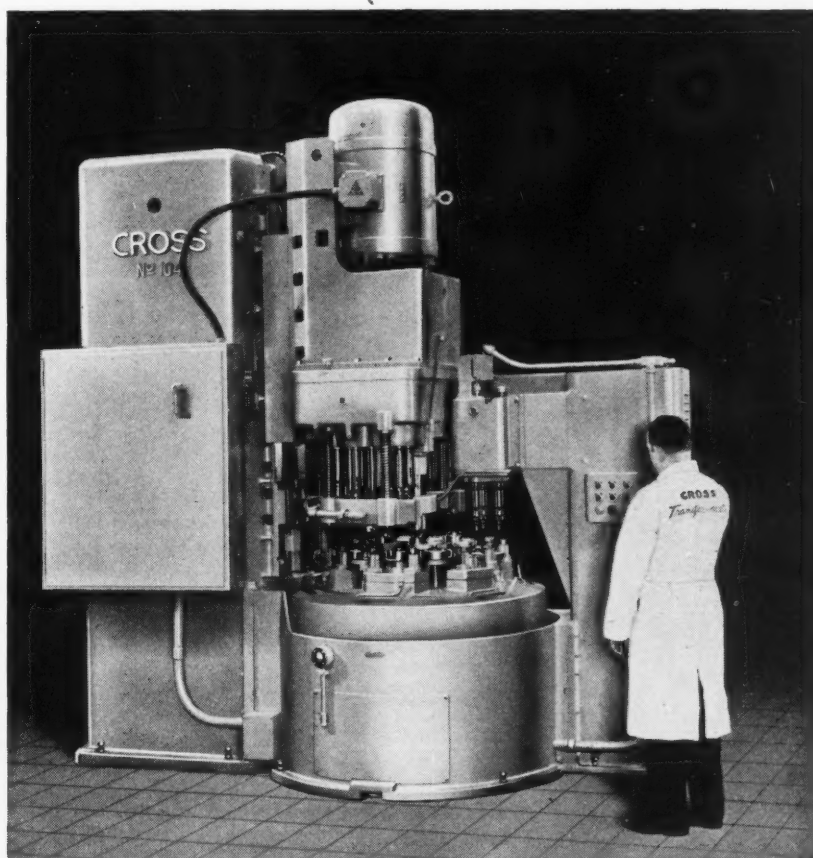
indexed through the eleven different machining positions.

A total of 168 cylinder stud holes are drilled, counterbored, and tapped at an angle of 90 degrees with the high-speed steel tools, which are hydraulically fed to the work. Power is supplied by seven motors. The entire operation is electrically interlocked for safety. The time cycle, exclusive of loading and unloading, is 2 minutes 19 seconds. The floor space required is 220 by 156 inches. _____ 72

Cross Automatic for Machining Planetary Gear Cages

An automatic-cycle special machine that requires only one operator for machining planetary gear cages has been built for a large automotive manufacturer by The Cross Company, Detroit 7, Mich. This new equipment drills, taps, reams, and counterbores seventy-five parts per hour. Operations on opposite sides of the part are handled simultaneously at each station by double loading.

Power clamping is provided for the work-holding fixture. The six-station indexing table is of the



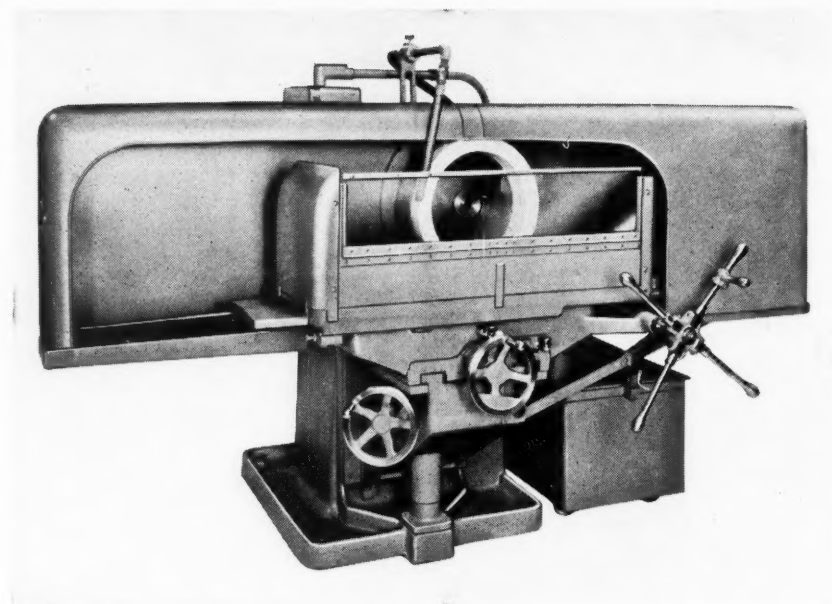
Automatic machine for machining planetary gear cages developed by The Cross Company

fluid drive type. Flexibility for part design changes is provided through the use of standard Cross units. The steel ways are hardened and ground. Feed and rapid traverse are hydraulically operated. 73

Face Grinder with Motorized Spindle

A 15-H.P., 900-R.P.M. motorized spindle furnishes an exceptionally powerful drive for the 18-inch wheel of a new face grinder announced by the Abrasive Machine Tool Co., East Providence 14, R. I. Box type ways, designed for maximum rigidity, and pre-loaded ball bearings for the spindle insure long life and chatter-free operation.

The 13- by 36-inch work surface permits grinding a wide range of work requiring flat, square surfaces, including automobile body dies and all types of molding and forging dies. Standard equipment includes a complete coolant system, with 60-gallon



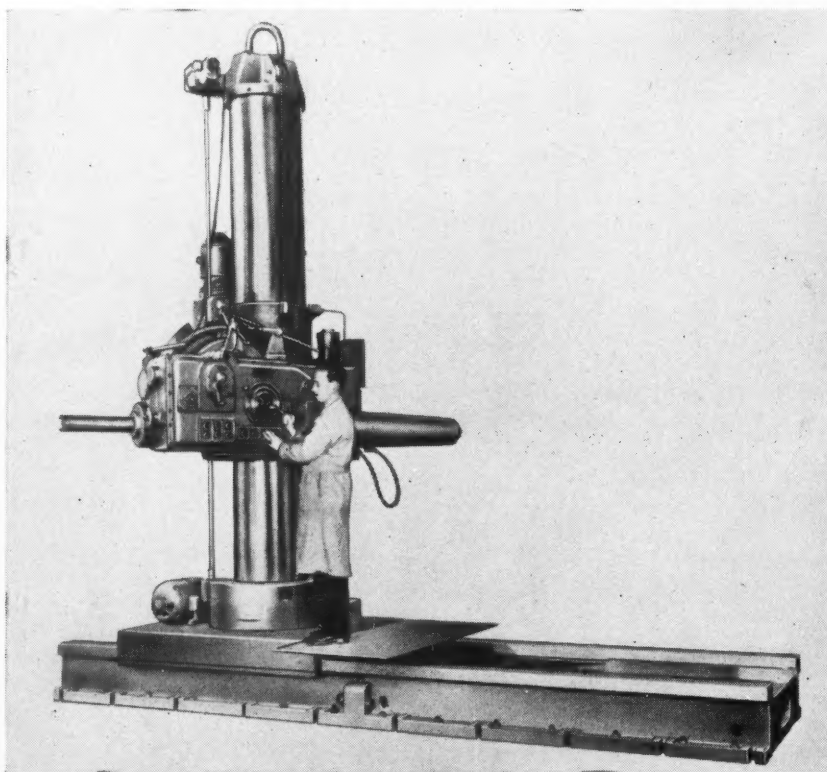
Face grinder with motorized spindle brought out by the Abrasive Machine Tool Co.

tank and table water guards. The machine requires a floor space of 6 by 8 feet, and weighs approximately 3900 pounds. 74

Kaukauna Heavy-Duty Drilling and Tapping Machine

The heavy-duty horizontal drilling and tapping machine illustrated has been developed by the

Kaukauna Machine Corporation, Kaukauna, Wis., whose sales organization is the Bryant Machinery



Kaukauna heavy-duty horizontal drilling and tapping machine

& Engineering Company, 400 W. Madison St., Chicago 6, Ill. The new machine, known as Model 1040, is designed for boring, drilling, tapping, reaming, and spot-facing operations. A driving range of 10 to 20 H.P. provides ample power for handling a wide range of sizes on production or job-shop work. The head swivels 45 degrees to increase flexibility and to eliminate the need for pit constructions, trunnions, and special holding fixtures.

The machine can be used as a stationary unit or as a portable unit with spreader arms, leveling jacks, and lifting bail. It is equipped with a nitrided spindle, 4 inches in diameter, having manual and power feed and a No. 5 or 6 Morse taper hole. There are three speed ranges—from 25 to 300 R.P.M.—and four feed ranges from 0.0035 to 0.125 inch per revolution. Thread leadscrews are provided for accurate tapping.

The entire rail and head assembly has a 48-inch vertical power traverse on the column, with inching controls for final tool positioning. The column head unit is mounted on a heavy runway with 48 inches of horizontal travel. The column is 22 inches in diameter and swivels 360 degrees to permit machining operations at any point around the machine. Spindle speeds and feeds are obtained by the rotary selector levers with direct-reading, conveniently positioned indicator dials. 75

Baldwin Universal Testing Machine with Push-Button Controls

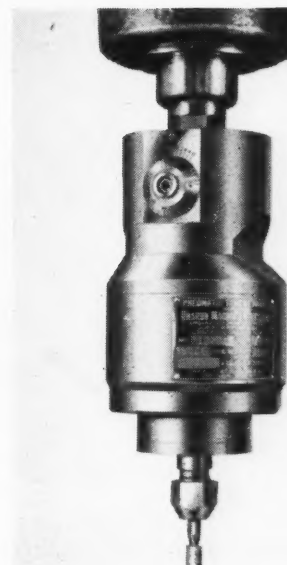
The development of an improved, low-cost universal testing machine of 60,000 pounds maximum capacity with two testing ranges has been announced by the Baldwin Locomotive Works, Philadelphia 42, Pa. The 60,000 pounds range is graduated in 100-pound units on a 16-inch diameter indicator dial, and the 12,000 pounds range is graduated in 20-pound units. This tester is designed with the hydraulic loading unit separate from the indicating and control unit, like the larger Baldwin machines. The recoil from breaking specimens is isolated. The two-unit design also permits varying the relative positions of the units in order to suit different requirements.

A motor drive for positioning the lower gripping head within the loading cage is a new feature furnished as standard equipment. The motor drive, including worm-gear and nut on the adjusting screw, is mounted on the lower cross-head, giving a range of travel of 17 inches at the rate of 10 inches per minute. Push-button controls are located on the front of the control cabinet. Load-

ing controls give infinitely variable speed between 0 and 2 inches per minute. The vertical distance between gripping heads ranges from 1 to 18 inches, and the clear lateral space between columns is 10 inches. The table is arranged for transverse testing and is drilled to secure standard transverse tools at spans of 12, 18, and 24 inches.76

Spring-Making Attachment for Drill Press

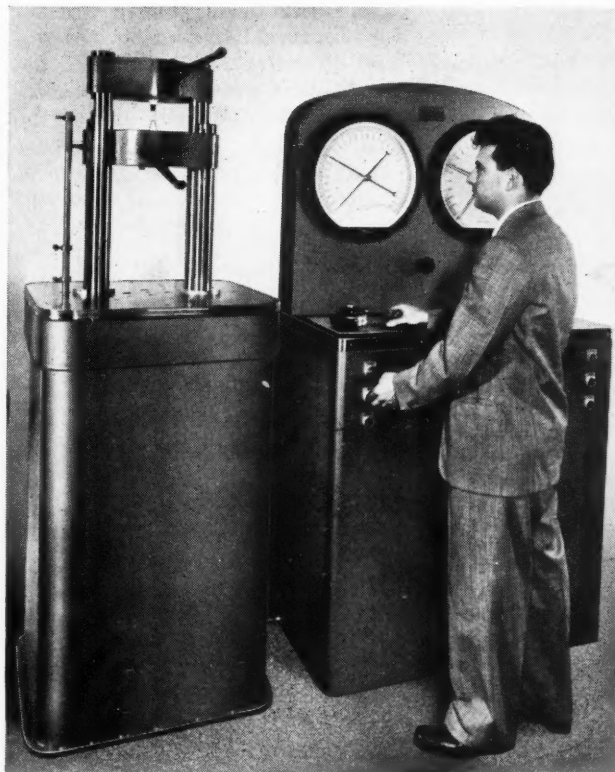
A "Spring-Master" attachment designed to convert a drill press into an efficient spring-making machine is being manufactured by the Cycloid Corporation, 12 Newhall Ave., Saugus, Mass. With this equipment, a 1/2-inch drill press can be employed for making springs at low cost to meet rapid production, development, or replacement requirements. Three spindles are provided which can be used for making springs having outside diameters of 3/16 to 5/8 inch from wire ranging from 6 gage (0.016 inch) to 28 gage (0.071 inch).77



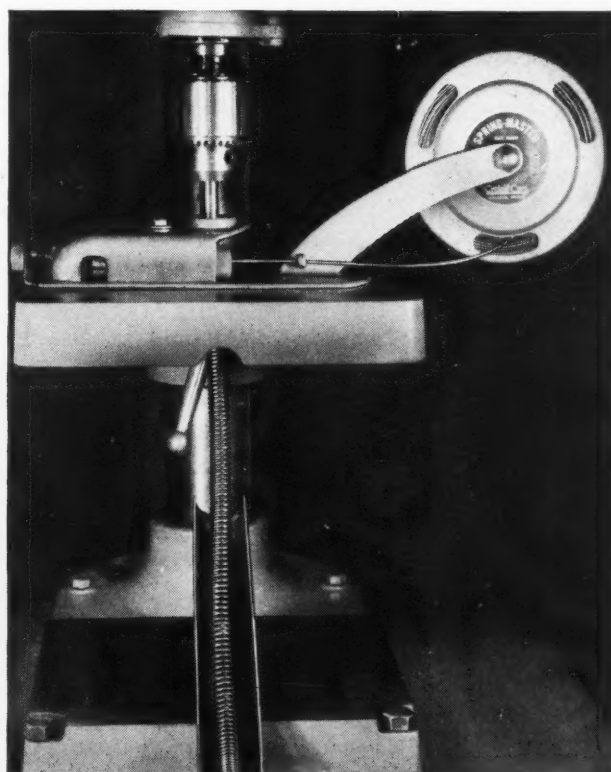
Air-turbine hole grinding unit introduced by Onsrud Machine Works, Inc.

Onsrud Air-Turbine Hole Grinder

A compact new precision hole grinding unit recently introduced to the metal-working industry by the Onsrud Machine Works, Inc., 3940 Palmer St., Chicago 47, Ill., consists of a high-speed air-turbine motor mounted on a Chandler



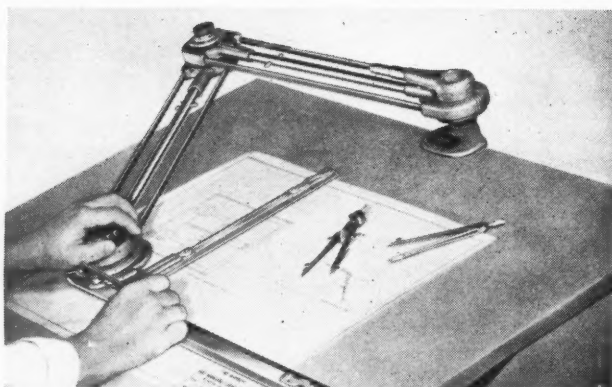
Universal testing machine announced by the Baldwin Locomotive Works



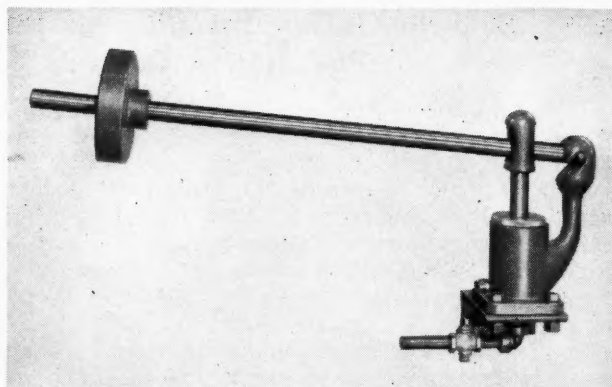
Spring-making attachment for drill press made by the Cycloid Corporation

To obtain additional information on equipment described on this page, see lower part of page 216.

MACHINERY, January, 1950—199



New drafting machine brought out by V. & E. Mfg. Co.



Weight-loaded lubricator made by Mixing Equipment Co.

boring and facing head. This unit is designed for use on jig borers, vertical and horizontal milling machines, boring mills, lathes, surface grinders, internal grinders, and drill presses. It can be used to locate and finish-grind holes with extreme accuracy. Vernier calibration permits reading of off-center head adjustment to 0.0001 inch.

The unit is built to operate without vibration at a speed of 50,000 R.P.M. on a line pressure of 100 pounds per square inch. It is designed for use with wheels from 1/8 to 3/4 inch diameter. Head adjustment permits grinding holes up to 2 3/4 inches in diameter, and an adapter plate expands the capacity to 4 inches in diameter. The head slide can be adjusted for off-center position from 0 to 1 inch in steps or increments of 0.0001 inch.78

"Vemco Versatilt" Drafting Machine

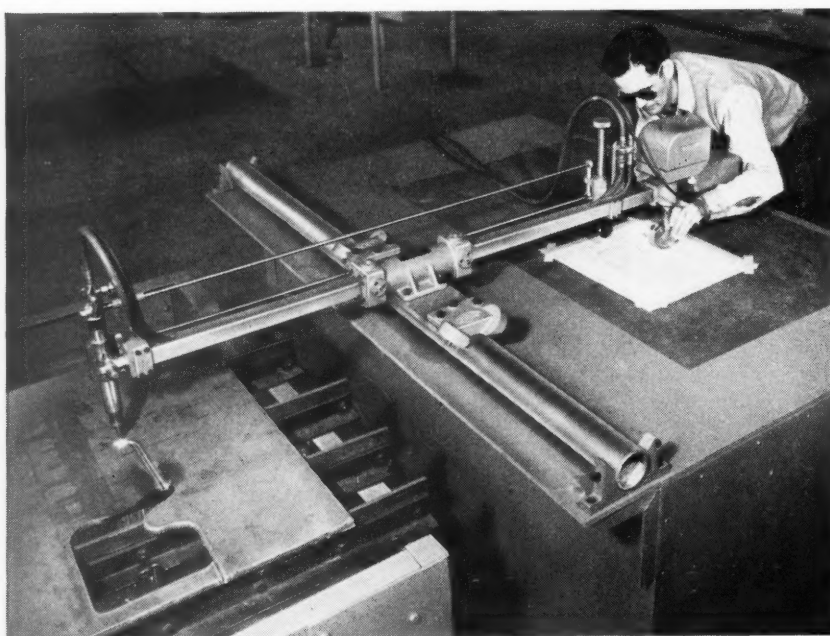
The V. & E. Mfg. Co., P.O. Box 950, Pasadena 20, Calif., has announced a new drafting machine designated the "Vemco Versatilt." This machine has a sturdy spring counterpoise attached to the support bracket, which permits it to function smoothly on a drawing-board tilted at any angle from 0 to 20 degrees.

The indexing mechanism is designed for setting off 15-degree positions, and includes a large thumb-piece so formed as to afford a secure grip. A simple vertical movement of the thumb releases and disengages the indexing mechanism for convenience in setting to angles other than multiples of 15 degrees. Other features include a positive scale-holder and a central skid button.79

Weight-Loaded Grease or Oil Lubricator

Development of a new weight-loaded lubricator has been announced by the Mixing Equipment Co., 1024 Garson Ave., Rochester 9, N. Y. This device is designed to deliver lubricant to machines at a constant selected pressure in any desired quantity. It can be used for either greases or oils, and is said to decrease maintenance costs, improve equipment operation, and lengthen machine life.

Any desired pressure up to 150 pounds per square inch can be applied to the lubricant by adjusting the weights on the lubricator arm. The device has a bracket for universal mounting, and a shut-off valve is available if desired. The grease cup has a capacity of 7 1/2 ounces, and can be easily refilled. A standard grease fitting is located at the bottom of the cup.80

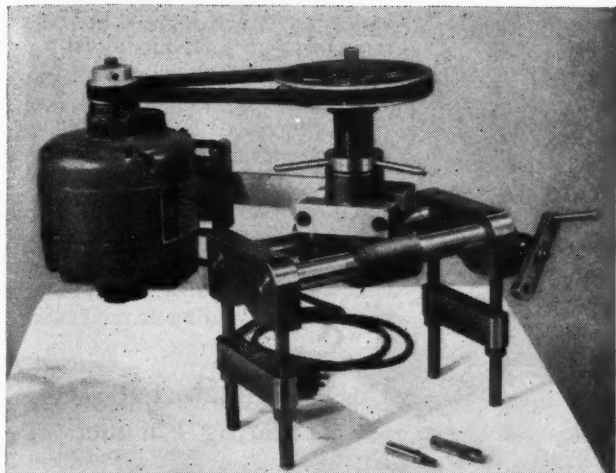


Portable Monograph shape-cutting machine brought out by Air Reduction

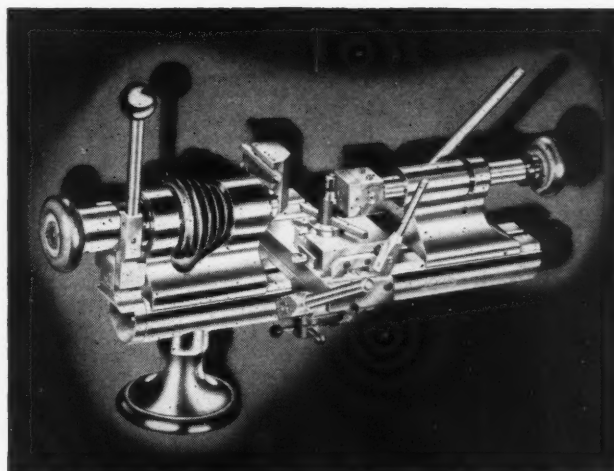
Airco Monograph Shape-Cutting Machine

Air Reduction, 60 E. 42nd St., New York 17, N. Y., has announced a new portable, low-priced, oxy-acetylene shape-cutting machine designated the "Airco No. 3 Monograph." This machine will cut steel up to 8 inches thick to any shape within a 56-by 32-inch area at speeds ranging from 3 to 30 inches per minute. The length of the cutting area can be extended by adding a tubular-rail extension. Straight-line, circle, and bevel cutting jobs can also be handled on this machine with a high degree of accuracy.

Since the Monograph machine weighs only 110 pounds and the tubular rail 35 pounds, the com-



Portable keyway milling machine brought out by the Keymil Mfg. Co.



Lathe with set-up for producing small precision parts, made by Louis Levin & Son

plete equipment can be readily transported from one job to another. The entire unit is packed in a case, which can be easily carried by two men and stored in a 7- by 1 1/2-foot space.81

Portable Keyway Milling Machine

A portable milling machine designed for accurate, rapid end milling of keyways in shafts from 5/8 inch to 3 1/2 inches in diameter has been brought out by the Keymil Mfg. Co., Mechanicsburg, R. D. 3, Pa. This "Keymil," as it is called, will mill keyways from 1/8 to 3/4 inch wide, 1/16 to 1/2

inch deep, and up to 6 inches long. It will also mill open-end keyways on the ends of shafts as required for couplings or cranks. The machine can be driven by a motor arranged as shown in the illustration, by a drill press, or by an electric or pneumatic drill at moderate speed.82

Levin Jeweler's Type Lathe Equipped to Produce Small Precision Parts

Louis Levin & Son, Inc., 782 E. Pico Blvd., Los Angeles 21, Calif., have announced the completion of a new line of accessories for their precision lathes of the jeweler's

type. These accessories have been designed to adapt the lathes for the manufacture of small precision parts and for fine tool work.

The collets and fixtures with which these lathes can now be equipped enable the sensitive "feel" of the skilled worker to be used to the best advantage in performing delicate machining operations. New accessories include double tool cross-slides, adjustable boring heads, and collet closers such as shown on the lathe illustrated. Other available equipment includes compound rest with three slides, wheel cutting and milling attachment, traverse grinder, countershafts with step pulleys, and idler stands.83

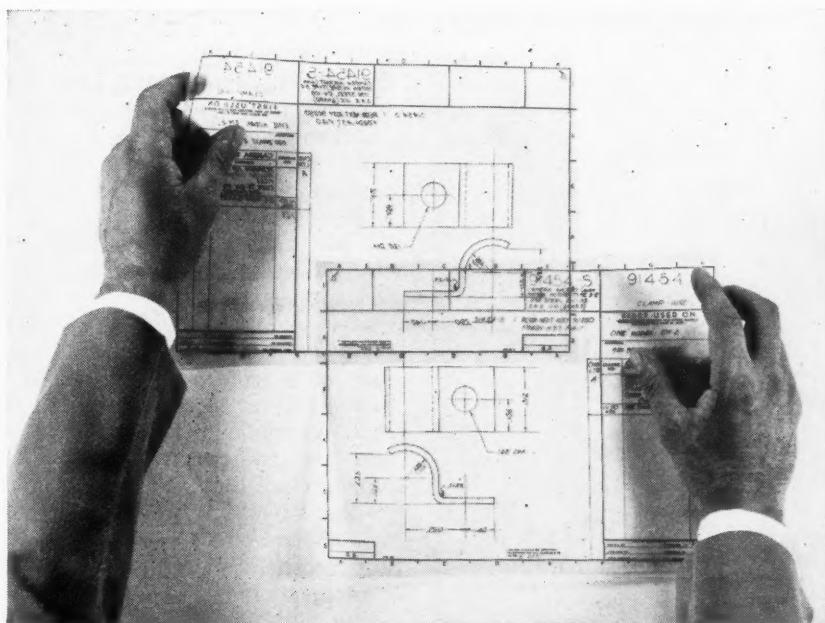
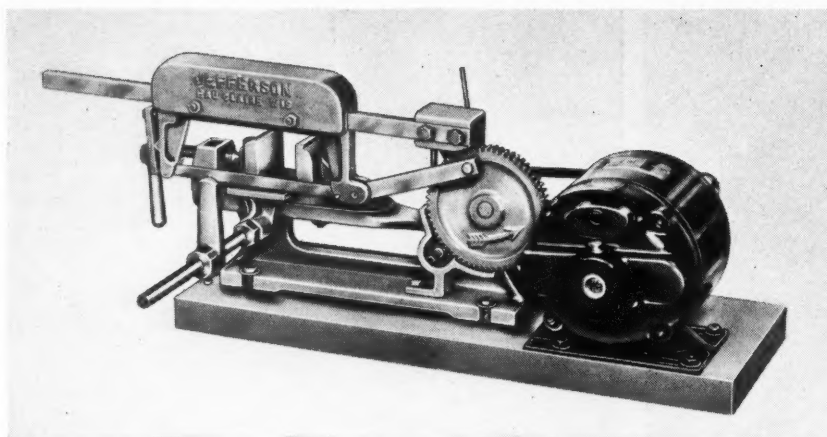


Illustration showing how drawings on "Kodagraph Autopositive" film can be read through the back. Identical copies of an engineering drawing are shown with the emulsion side down and with the emulsion side up

Autopositive Film Designed to Provide Maximum Print-Back Speeds

The "Kodagraph Autopositive" film is a direct-positive film developed by the Eastman Kodak Co., Rochester 4, N. Y., for making reproductions of engineering and architectural drawings, maps, and physical surveys. The new film can be handled in normal room light, and produces a positive copy directly from a positive original drawing without a negative step. It can be exposed on blueprint, whiteprint, or other copying machines having a high-intensity light source.

This film is especially adapted for restoring worn, stained, or faded drawings without the necessity of retracing by hand. Its printing speed makes it particularly valuable for turning out large quantities of shop prints in



Jefferson power hacksaw announced by Sales Service Machine Tool Co.

the shortest possible time. The film is available in both 30- and 100-foot rolls and in widths of 24, 30, 36, 42, and 44 inches....84

Jefferson Power Hacksaw

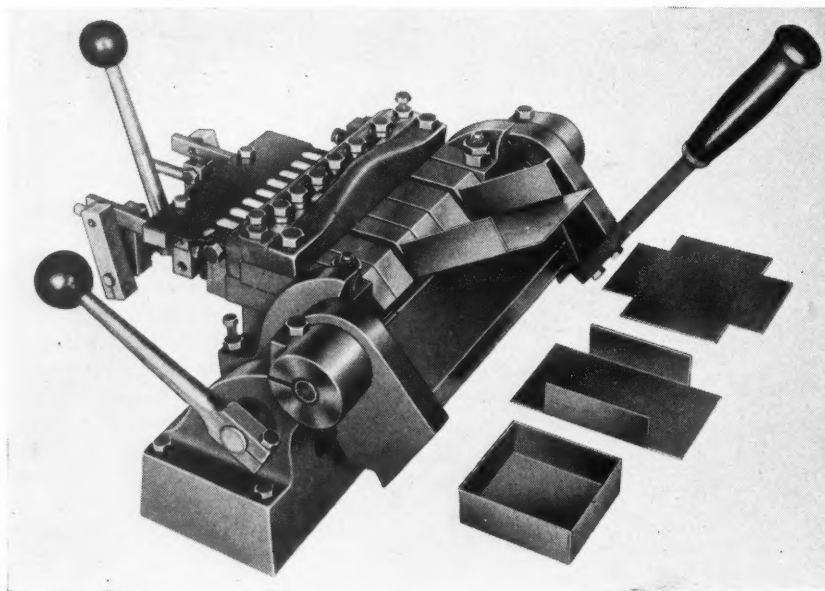
A Jefferson 601 power hacksaw has recently been announced by the Sales Service Machine Tool Co., 2363 University Ave., St. Paul 4, Minn. Although of small size, the new hacksaw provides fast, accurate cutting of material up to 2 3/8 by 2 3/8 inches, and permits angle cutting of 1 5/8-inch stock. It is equipped with a 1/4-H.P., single-phase, 1725-R.P.M. motor for operation at the rate of 150 strokes per minute. The length of the full cutting stroke is 3 1/2 inches.

An 8-inch blade is furnished with the saw, and there is an ex-

tension bar to accommodate 10-inch blades. Pressure relief on the return stroke eliminates drag and unnecessary blade wear. A gage-bar permits cutting uniform length pieces. The frame can be held in the raised position by a latch. Take-up to compensate for wear of the frame is provided...85

Precision Box Fingers for Di-Acro Brakes

All Di-Acro brakes, made by the O'Neil-Irwin Mfg. Co., 332 Eighth Ave., Lake City, Minn., can now be quickly converted into precision box and pan brakes by merely using a new box finger bar in place of the solid top bar regularly supplied with these brakes. The box finger bar contains fingers graduated in size, so that they cover the entire box forming



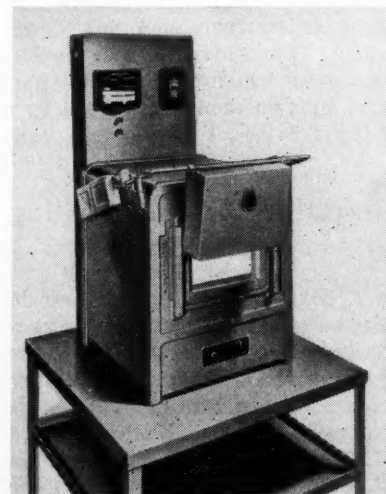
Di-Acro box finger brake equipped with "Adjustomatic" gage

range, from 1/2 inch to the maximum size of each model Di-Acro brake in 1/8-inch steps.

The box finger bar can be readily mounted on brakes now in use. Another available accessory for the box finger bar is an open-end finger by means of which it is possible to form triangular, square, and rectangular tubes, as well as other parts that entirely enclose the forming bar.86

Cooley Bench Type Heat-Treating Furnace

To meet the demand for greater capacity in bench type heat-treating furnace equipment, the Cooley Electric Mfg. Corporation, 38 S.



Bench type furnace brought out by the Cooley Electric Mfg. Corp.

Shelby St., Indianapolis, Ind., has brought out a furnace having a chamber 10 inches wide, 8 inches high, and 18 inches long for operation at temperatures up to 1850 degrees F.

This furnace is available in two models. The VK-48 machine is equipped with a Cooley selective power modifier, which permits manual setting of power input at any point from 5 to 100 per cent of the full rating capacity. A control pyrometer permits the high and low temperatures to be held within close limits.

The VH-48 model is designed for control-pyrometer operation, but without auxiliary control equipment. It is adapted for hardening and tempering where uniformity at the lower temperatures is not too critical. Either of these furnaces is suitable for use in tool

and die hardening and tempering, and for batch production runs of small parts.87

Portable Ultrasonic "Reflectoscope"

Functional changes in styling and external design, together with modifications that facilitate interpretation of test results, are features of a new model portable ultrasonic "Reflectoscope" for testing metals, announced by



Ultrasonic "Reflectoscope" for detecting flaws in metals, made by Sperry Products, Inc.

Sperry Products, Inc., Danbury, Conn. The instrument is used for testing steel billets, forgings, castings, finished stock, and a wide variety of machined parts, including shafts, axles, rolls, piston-rods, bolts, and studs. Welds in steel plate, pipes, and containers are tested by means of the angle-beam technique, in which ultrasonic vibrations enter and leave the tested material at an acute angle and travel through the material by successive reflections between the surfaces...88

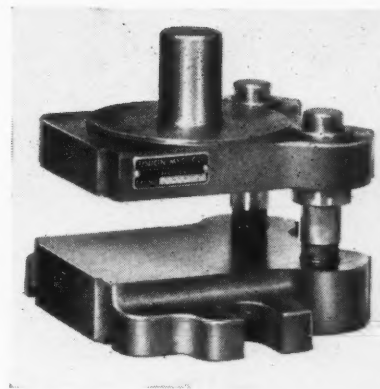
"Flamecraft" Oxy-Acetylene Outfit

Air Reduction, 60 E. 42nd St., New York 17, N. Y., has announced the availability of a new "Flamecraft" oxy-acetylene welding and cutting outfit. This equipment, marketed

as a "packaged" unit, includes oxy-acetylene cylinders, welding torch, cutting attachment, tips, regulators, hose, goggles, cylinder truck, fluxes, an assortment of welding and hard facing rods, and an instruction folder on the proper handling and operation of the equipment.89

"Unaloy Ultra-Precision" Die Sets

The Union Mfg. Co., New Britain, Conn., has announced an "Ultra-Precision" die set made to the requirements of proposed standards set up by the American Society of Mechanical Engineers. This set is being produced in eighteen sizes with die spaces ranging from 3 inches left to right by 3 inches front to back up to 14 inches left to right by 10 inches front to back. The castings for these die sets are made of a semi-steel mixture known as "Unaloy," developed for this purpose by the manufacturer.



"Ultra-Precision" die set brought out by the Union Mfg. Co.

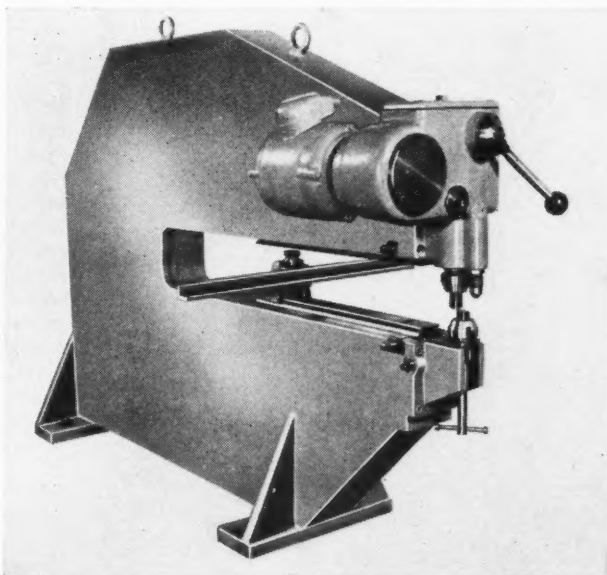
The precision guide posts of these die sets are hardened, ground, and machine-lapped to close tolerances. They can be furnished in lengths of from 4 to 6 inches, inclusive, varying by increments of 1/4 inch; from 6 to 9 inches, varying by 1/2 inch; and from 9 to 12 inches, varying by 1 inch. Standard shanks are 1 1/2, 1 9/16, 2, and 2 1/2 inches in diameter.90

Pullmax Improved Sheet-Steel and Plate Cutting Machine

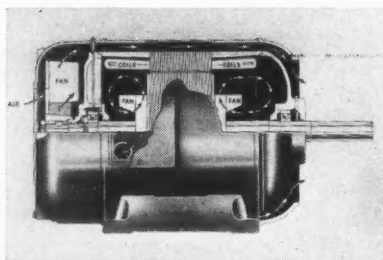
Several improvements have been incorporated in a Model P-5 sheet-steel and plate cutting machine recently added to the line of machines sold by the American Pullmax Co., Inc., 2627 North Western Ave., Chicago 47, Ill. The new machine is capable of straight, circular, and irregular cutting, in addition to folding, beading, and slotting. The mechanism of this cutting machine is entirely en-

closed and operates in an oil bath.

The circle- and straight-cutting attachments are equipped with quick locking devices that permit size changes in one movement. The machine has an edge cutting capacity ranging from the finest gages up to 7/32 inch in mild steel, and will cut circles from 3 5/32 up to 40 inches in diameter. It has a throat depth of 42 inches.91



Sheet-steel and plate cutting machine placed on the market by the American Pullmax Co.



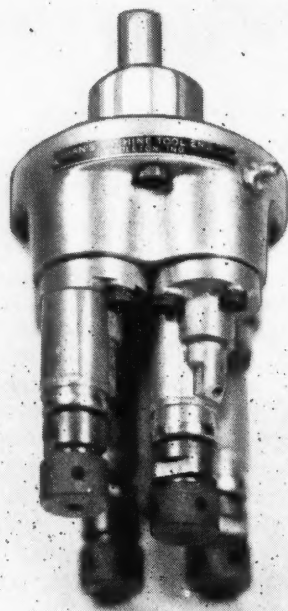
Valley Electric Totally Enclosed Fan-Cooled Motor

Air-cooled, ball-bearing, polyphase, 50- or 60-cycle, constant-speed, induction motor with high torque and low starting current. Built in sizes from 2 to 60 H.P. This Type TEFC motor has a totally enclosed housing, which prevents any foreign matter from penetrating the windings. Air is drawn in through the external hood and then passed over the stator core and out over the pulley bearing, while small fan blades on the rotor serve to circulate the air inside, transferring the heat to the frame and end bells, as indicated in the cut-away view. Manufactured by the Valley Electric Corporation, Department 130, 4221 Forest Park Blvd., St. Louis 8, Mo.92

Midget Multiple-Spindle Adjustable Drill Head

Midget-size, multiple-spindle drill head available with either a straight-shank drive-shaft or a No. 1 Morse taper drive-shaft for use on any make of

drill press. Designed for drilling holes from 0.013 to 0.1875 inch in diameter in metal, wood, and plastic materials. The four-spindle head shown has a close center setting of 1.218 inches and a wide center setting of 2.375 inches in a bolt circle; or 7/8 inch and 1 11/16 inches in a square pattern. The two-spindle model has a close center setting of 0.750 inch, and a wide

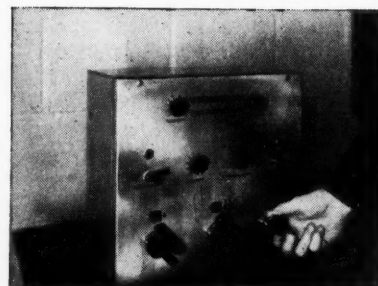
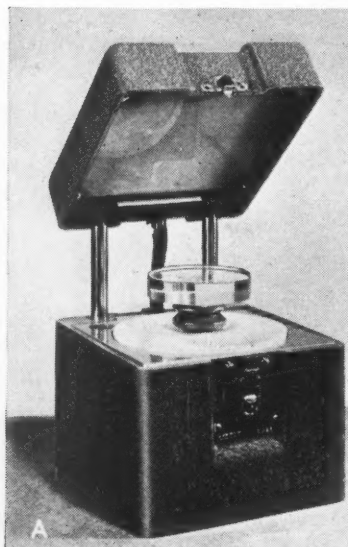


center setting of 2.062 inches. Made by Aiman's Machine Tool & Engineering Co., Inc., 109 S. Broadway, Pendleton, Ind.93

"Lapmaster" Monochromatic Light and Optical Flat

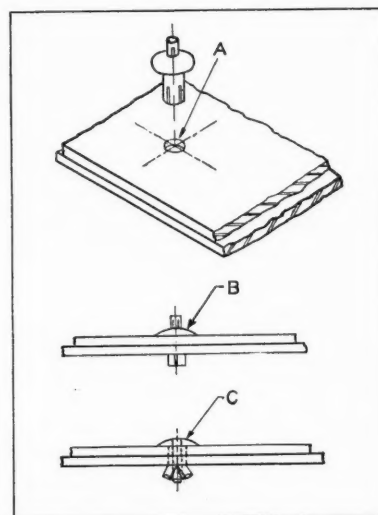
Precision measuring "Lapmaster" optical flats and monochromatic lights for checking flatness accuracy to less than one light band (0.0000116 inch). Marketed by the Crane Packing Co., 1800 Cuyler Ave., Chicago 13, Ill. The

light source and checking stage are a self-contained unit housed in a sturdy aluminum case, which is adjustable from the stage type, shown in view (A) at the left, to the bench type, shown at (B), for checking long or tall pieces.94



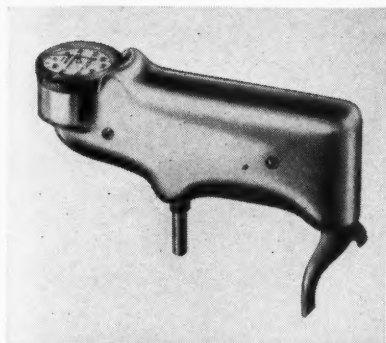
Westinghouse X-Ray Thickness Gage

New X-ray thickness gage designed to measure, in steps of 0.0001 inch, cold-rolled steel strips ranging in thickness from 0.0050 to 0.1196 inch. This gage compares the amount of X-ray absorption from two X-ray beams identical in intensity, one through a sample of steel of the exact thickness to be rolled, and the other through the steel strip being rolled. The results are readily interpreted visually. Available from Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.95



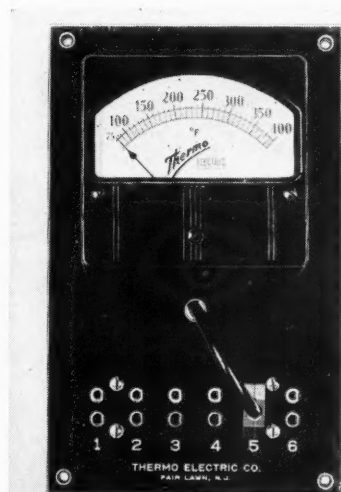
"Southco" Blind Rivets

"Southco" blind rivet designed to meet all requirements for blind fastening of metal to metal. Can also be used to attach metal to wood, plywood, or ply metal. Consists of a slotted tubular rivet with an inserted grooved pin. When used for blind fastening of metal to metal, a hole of the correct size for the rivet is drilled, as shown at (A). After removing all burrs, the rivet is inserted so that the head is firmly seated, as seen at (B). The rivet is then expanded, as shown at (C), by driving the pin flush with the surface of the rivet head. Made in eight shank diameters ranging from 3/16 to 1/2 inch, with nominal grip lengths of 3/32 to 5/8 inch. Regularly stocked in 3/16- and 1/4-inch diameters in brazier and 100-degree countersunk head styles. Announced by South Chester Corporation, Finance Bldg., Philadelphia 2, Pa.96



Barber-Colman Impressor Hardness Tester

Fabricated plastic or non-ferrous metal parts can be rapidly tested with this hand type hardness tester brought out by the Barber-Colman Co., 1249 Loomis St., Rockford, Ill. The new tester is suitable for the spot-checking of stock. It can be used in any position and in any area which will admit the operator's hand. The hardness reading is taken on a conveniently located dial.97

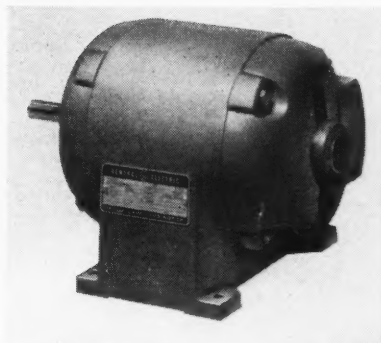


Multiple-Point Pyrometer Indicator

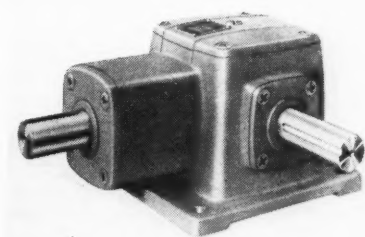
Multi-point pyrometer and quick-coupling connector panel assembly designed for indicating temperatures at from one to six thermo-couple locations with operating ranges from 75 to 400 degrees F., 1000, 1600, and 2300 degrees F., and minus 300 to plus 300 degrees F. Introduced by Thermo Electric Co., Inc., Fair Lawn, N. J.98

G-E "Tri-Clad" Motor

"Tri-Clad" capacitor motor in compact, light-weight design with totally enclosed built-in starting switch designed to keep foreign matter from the contacts and a completely new and tested centrifugal mechanism developed for long dependable life. Made in ratings of 1/2 to 5 H. P. and in two types for capacitor-

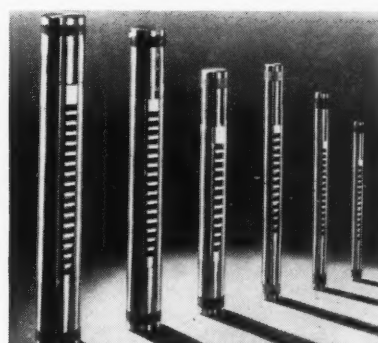


start and capacitor-run service. Built by the General Electric Co., Schenectady 5, N. Y.99



Right-Angle Drive Unit

New right-angle drive unit which has special spiral bevel gears, casehardened and lapped in pairs after hardening. The units range from 6 to 12 H. P. in five ratios from 1 to 1 up to 4 to 3. Made by Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.100



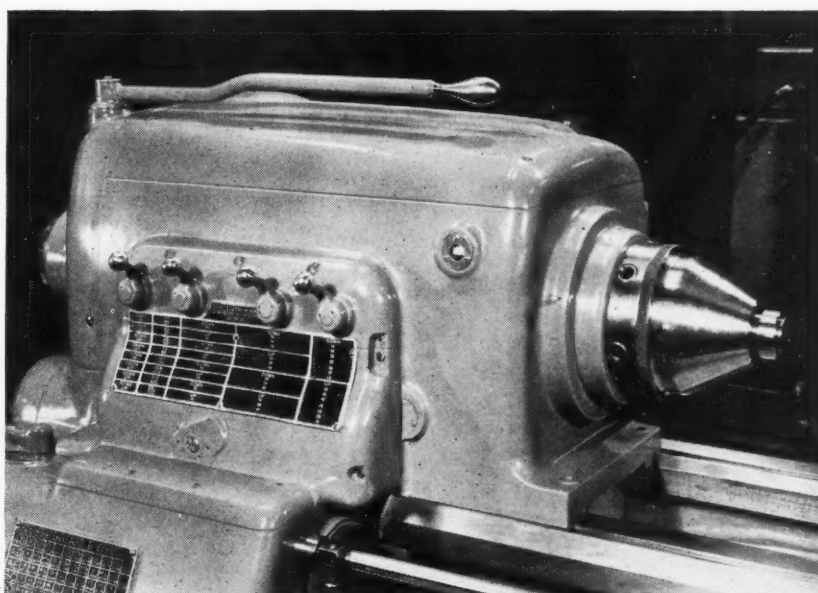
Glenny Broach Line Expanded

New broaches brought out by the Kase Machine Co., 18429 Buffalo Ave., Cleveland 19, Ohio, to expand its standard line of Glenny broaches to include sizes from 5/16 inch to 2 inches, varying by increments of 1/16 inch. A 2 1/2-inch broach is also available as part of the standard line. This new expansion in size range now makes it possible for any one of the standard twenty-eight broaches to be had with as many as four different blade widths for cutting a wide variety of keyways in gears, bushings, hubs, and other metal or plastic products. Bushing type adapters are available with all the new size broaches to permit cutting keyways in bores larger than standard broach diameters. All new sizes have teeth designed to provide a large chip chamber. End nuts facilitate rapid, fine adjustment for depth of cut.101

Lever-Operated Collet Attachment for Monarch Lathes

Lever-operated collet attachment with capacity for handling round bar stock up to 1 1/8 inches in diameter, brought out by the Monarch Machine Tool Co., Sidney, Ohio, for application on all Monarch Series 60 engine and tool-

room lathes. Designed for installation at the factory only. Can be used for either draw-in or pusher type collets. Both types are interchangeable and identical except for the draw-bar, collets, and spindle-nose adapter.102



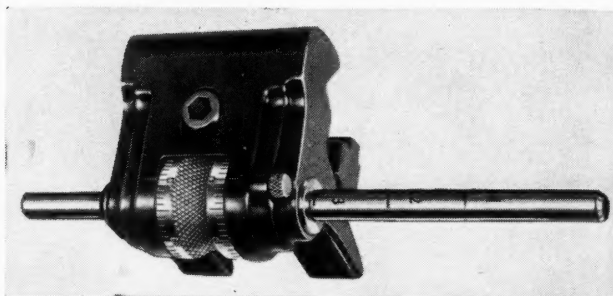
To obtain additional information on equipment described on this page, see lower part of page 216.

MACHINERY, January, 1950—205



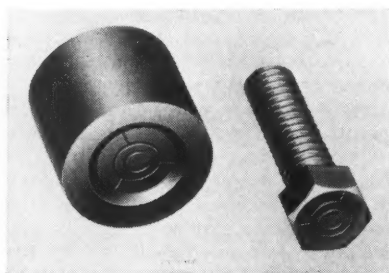
"Roto-Master Hi-Speed" Grinder for Roughing and Finishing

New "Roto-Master Hi-Speed" grinder designed for use on 110- to 130-volt alternating or direct current at 38,000 R.P.M. for performing roughing and finishing operations with carbide rotary files. Carbide burrs and mounted wheels can be used. Announced by the Metal Removal Co., 1014 N. Ashland Ave., Chicago 22, Ill.103



Harper Lathe-Carriage Spacer and Micrometer Stop

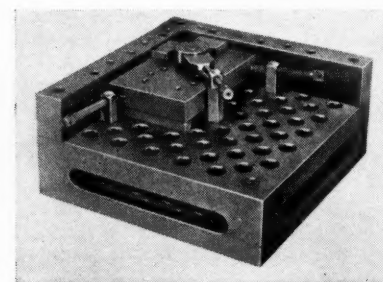
Combination micrometer stop and lathe-carriage spacer which is built to fit any lathe and can be attached or removed in five seconds. Adjustable by increments of 0.001 inch from 0 to 6 inches. Adapted for use in boring, turning, and facing. Introduced by Ellwood Products Co., 3049 E. Grand Blvd., Detroit 2, Mich.104



Carbide Heading Hammers with Markings

Combination bolt-heading and marking hammer of solid carbide with bolt marked and headed by the hammer on an automatic bolt-heading machine. Hammers of this type are now available from the Carboloy Company, Inc., 11147 E. Eight Mile Blvd., Detroit 32, Mich.105

school and service shops, experimental departments, and light assembly production plants, as well as for model building. Four collets, which handle standard tap shank sizes and taps from Nos. 0 through 1/4 inch, are supplied with each tapper. Announced by R. D. Herder Tool Specialties Co., 2424 Brook Drive, Kalamazoo, Mich.106



Allen-Bradley Motor Starter

Co., 53 Park Place, New York 7, N. Y. These drilling plates have clamps that hold the work securely against side rails and are easy to set up. Gage-blocks and the master drill disk locate the position of the hole.108

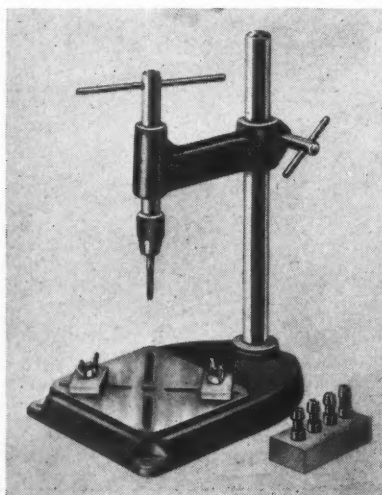
Precision Hand-Tapper

Bench type hand-tapper designed for precision small-hole tapping. Primarily intended for use in tool and die shops,



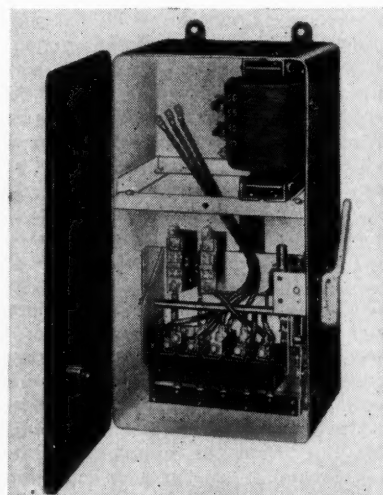
"Super Alloy" Flexible Stainless-Steel Hose

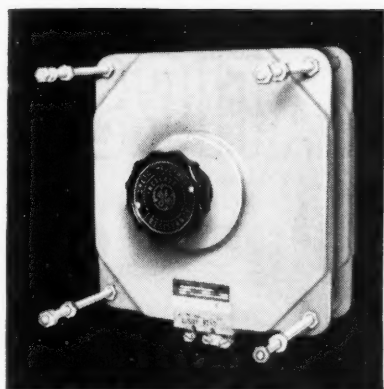
Flexible stainless-steel hose now being produced commercially by the Alloy Tube Division of the Carpenter Steel Co., Union, N. J., in a highly corrosion-resistant alloy designated Carpenter Stainless No. 20. This hose is made in sizes ranging from about 1 inch to 2 5/8 inches inside diameter, in various gages.107



Montgomery Universal Drilling Plate

Universal drilling plate designed to eliminate jigs and fixtures in drilling and reaming accurately spaced holes. Recently introduced by Montgomery &





General Electric Plate Type Rheostat

Plate type rheostat announced by General Electric Co., Schenectady 5, N. Y. Available in three forms, including sequence and concentric rheostats, as well as sprocket and motor mechanisms. Specifically designed for field control of direct-current shunt- or compound-wound motors, self-excited generators, exciters, separately excited generators, and synchronous motors. Adapted for use on machine tools and a wide range of motor-driven machinery.110

Dayton-Rogers Die Cushions

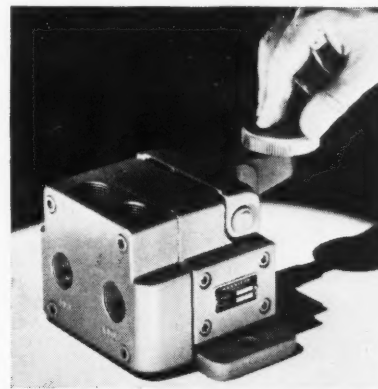
New design of pneumatic die cushion announced by the Dayton Rogers Mfg. Co., Minneapolis 7, Minn. These Model 2CC-16 die cushions can be operated



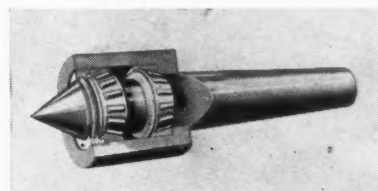
from the average shop air line, and are provided with pressure lubrication fittings. The design is adaptable to large straight-side presses. The ring holding pressure developed by the die cushions varies from 15 to 25 tons. The extra heavy-duty pin pressure pads are made in sizes of 28 by 36 up to and including 34 by 48 inches, and are made to fit the individual press bed opening. ...111

Hannifin Air Valve with Push-Button Control

Fast cycling type hand-operated valve which provides four-way directional air control for the operation of single- or double-acting pneumatic cylinders and other air-operated equipment. Light pressure on a control knob is all that is required to operate the valve. Made in 1/2- and 3/4-inch sizes for use with air-line pressures of 25 to 150 pounds.



Air-line connections are located in the top of the valve with pipe connections to air cylinder in the back. Announced by Hannifin Corporation, 1110 S. Kilbourn Ave., Chicago 24, Ill.113



Scully-Jones Live Center

Live center brought out by Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill., for use on lathes and other machines employed for machining heavy work at high speeds with carbide-tipped tools. Equipped with Timken tapered roller bearings, the load carrying capacity is 1000 pounds in the Nos. 2 and 3 Morse taper sizes, and up to 2400 pounds in the Nos. 4 and 5 Morse taper sizes.114

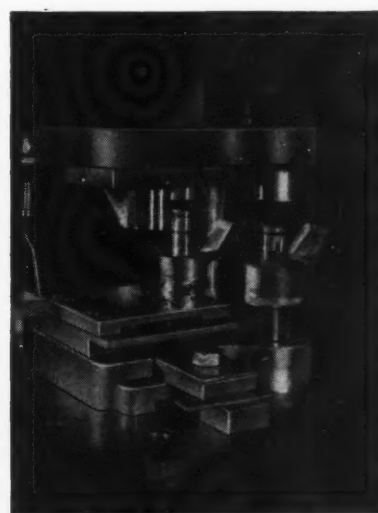
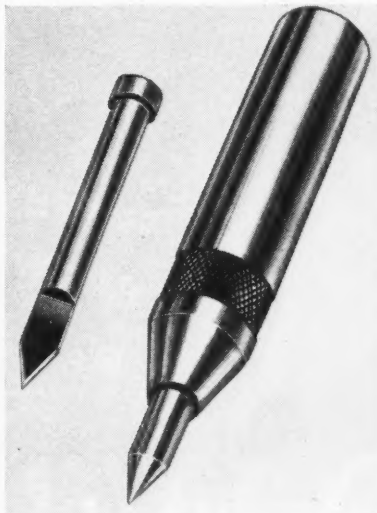
Acro Oilers for Die-Set Leader Pins

Oilers for automatically lubricating die-set leader pins, consisting of oil wells that can be slipped over the pins

Craley Extension Collet-Holder and Spring Scriber

(Left) Extension collet-holder and collets. This holder is 3 inches long, and the shank is ground to a diameter of 0.500 inch for use in any standard collet. Its extension end is ground to a diameter of 0.625 inch for use in checking settings. The three collets hold end-mills or cutters 0.125, 0.1875, and 0.250 inch in diameter. (Right) Spring scribes, hardened and ground, with 0.1875-inch

lapped hole to insure smooth action of scribing points. Holder is approximately 2 3/4 inches long. The two interchangeable high-speed steel scribes are ground with 60-degree angular points. One has a flat surface ground on one side to facilitate scribing lines or lay-outs close to shoulders. Products of C. E. Craley Tool Co., 110 Chestnut St., Shillington, Pa.112



To obtain additional information on equipment described on this page, see lower part of page 216.

See why today's **AUTOMATICS**
are much more productive
than older models

Compare

**A New Design
No. 00G
with Older Machines**

Spindle Drive	Maximum	Chain	6050 R.P.M.
Spindle Speeds	Minimum		50 R.P.M.
Number of Spindle Speeds			196
Ratio -- Low and High Speeds			Two speed Combinations
Spindle Bearings			Fourteen
Preloaded Spindle Thrust Bearing Assembly			1:1.6 to 1:13
Improved Spindle Labyrinth			Double Roller and Preloaded Ball
Capacity	Regular	Yes	
	For Light Work	Yes	
Time for Feeding Stock and Indexing Turret		3 8" Dia.	
Improved Feed Slide Assembly		1 2" Dia.	
Speed and Feed Change Gears Readily Accessible from Front Operating Position		1 4 Sec.	
Transmission Mechanism		Yes	
Automatically Lubricated		Yes	
Self-contained Driving Mechanism -- Chain-driven from Motor		Yes	
Designed to Receive All Standard Attachments		Yes	
Automatic Overload Release on Camshaft and Feed Slide Mechanism		Yes	

**IMPORTANT
CHECK POINTS**

**ARE YOUR
AUTOMATIC
SCREW MACHINES
OBSOLETE**

?

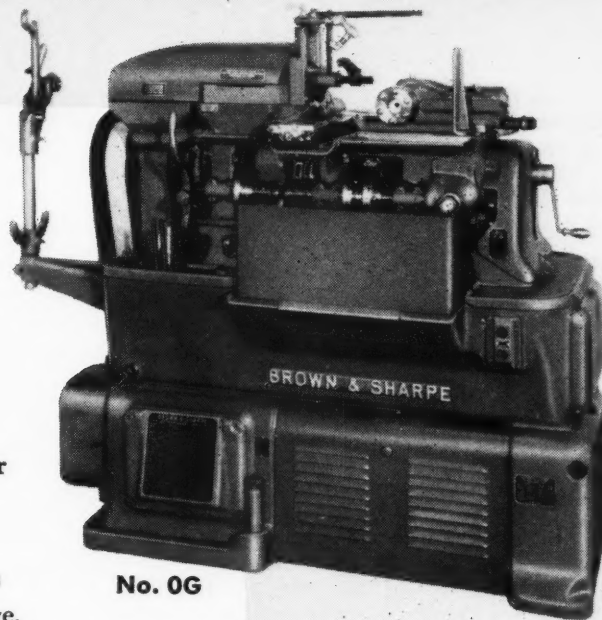
Compare them with
BROWN & SHARPE
New Design Automatics

BROWN &

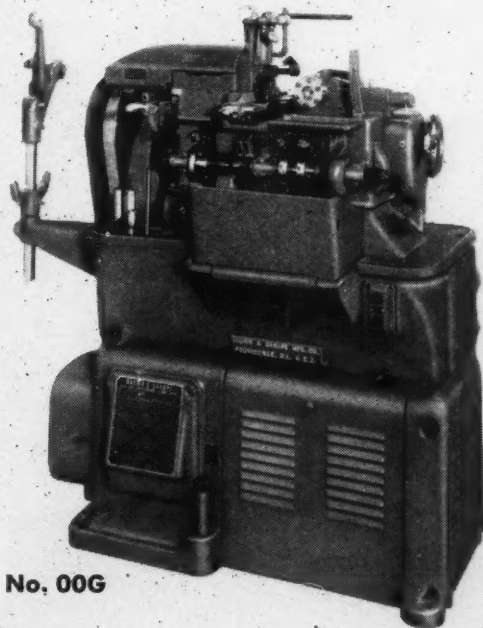
Maximum production per hour from every machine tool in your plant is more essential than ever, as today's conditions become increasingly competitive.

The new Brown & Sharpe Bulletin at the left shows how you can gain by replacing older automatic screw machines with those that embody the very latest features in design and construction. Features of today's Brown & Sharpe models and previous models, in chart form, make comparisons easy . . . fast . . . positive.

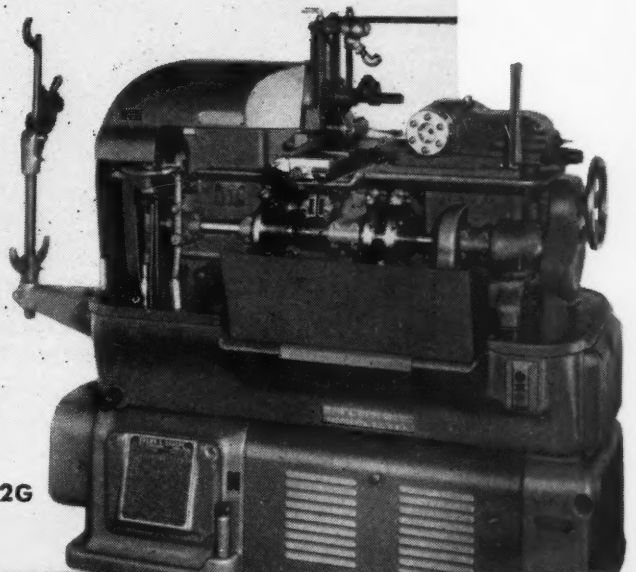
Send for your copy of this handy, helpful bulletin and guide, "Are Your Automatic Screw Machines Obsolete?" It covers the facts that you would ordinarily collect and correlate before making an investment. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.



No. 0G



No. 00G

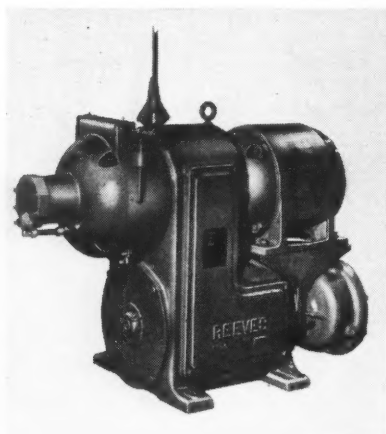


No. 2G

SHARPE

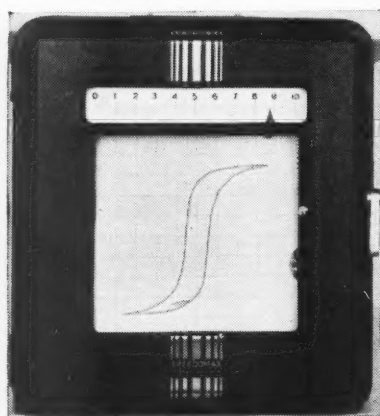


and adjusted to the proper height. Are available in a range of sizes to suit various leader-pin diameters from the Acro Metal Stamping Co., 338 E. Reservoir Ave., Milwaukee 12, Wis.115



Hydraulic Control for Reeves "Vari-Speed Motodrive"

Hydraulic control developed by Reeves Pulley Co., Columbus, Ind., for use on the "Vari-Speed Motodrive." With this control, it is possible automatically to control tension, velocity, pressure, temperature, and liquid level of material in process, as well as to synchronize the operating speeds of machines in the production line or of parts of the same machine. The same control without the hydraulic power plant is available for pneumatic operation.116

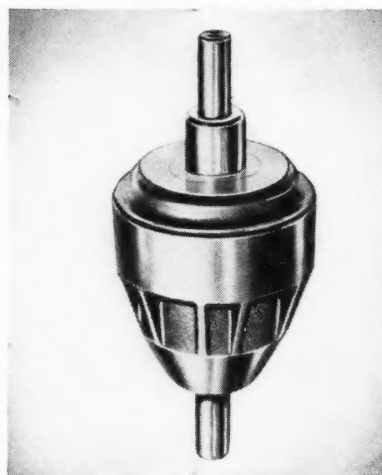


Leeds & Northrup "Speedomax Recorder"

New "Speedomax Recorder" which automatically plots the relationship between two variables, showing one as a function of the other, thereby eliminating compilation and manual plotting. The variables are plotted by direct-current signals. The result is a permanent record, accurately plotting, in minutes, data that would require hours with the usual method. Made by the Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa.117

"Augur-Movement" Power Transmission

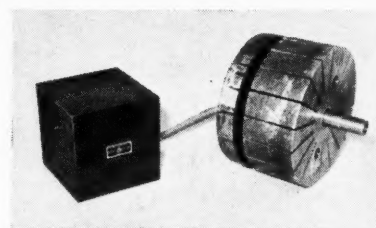
Unique power transmission that converts and reduces a constant-speed input to a quick-reversing action that interrupts the rotation of the output shaft every 45 degrees of travel. Originally designed as a machine tool accessory for performing honing and lapping operations, it is also recommended as a power transmission for hopper feeds, buffing and polishing machines, tumbling barrels, screw-feed stokers, and



similar equipment. Introduced by Metal Seal & Products, Inc., 21859 St. Clair Ave., Euclid 17, Ohio.118

"Electrothrust" All-Electric Power Unit

All-electric power unit capable of applying pressures up to several tons for operations requiring pressure or impact ordinarily obtained by means of air and hydraulic cylinders. This "Electrothrust" unit is available with strokes ranging from a fraction of an inch to several inches in length. Can be operated from an alternating-current light-



ing circuit. Product of Black & Webster, Inc., 30 Pleasant St., Needham 92, Mass.119

Bit Stock Drill Set in Plastic Case

Bit stock drill set contained in a new type plastic case. Recently placed on the market by Whitman & Barnes, 40600 Plymouth Road, Plymouth, Mich. Hinged top of case is transparent. The No. 13 set shown contains nine drills

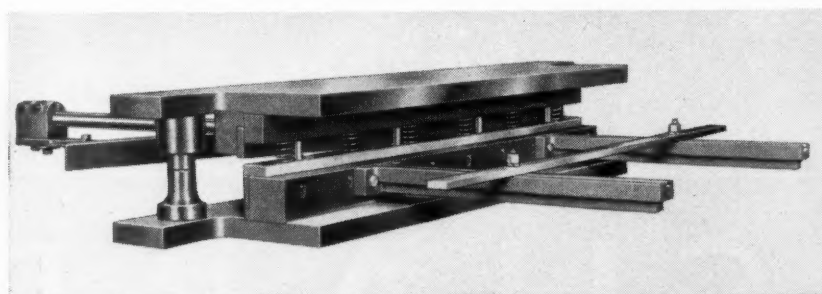


ranging from 1/16 to 3/8 inch in diameter; set No. 13A contains seven drills from 1/8 to 3/8 inch in diameter; and set 13B, nine drills from 1/8 to 1/2 inch in diameter.120

Shearing Die for Punch Press

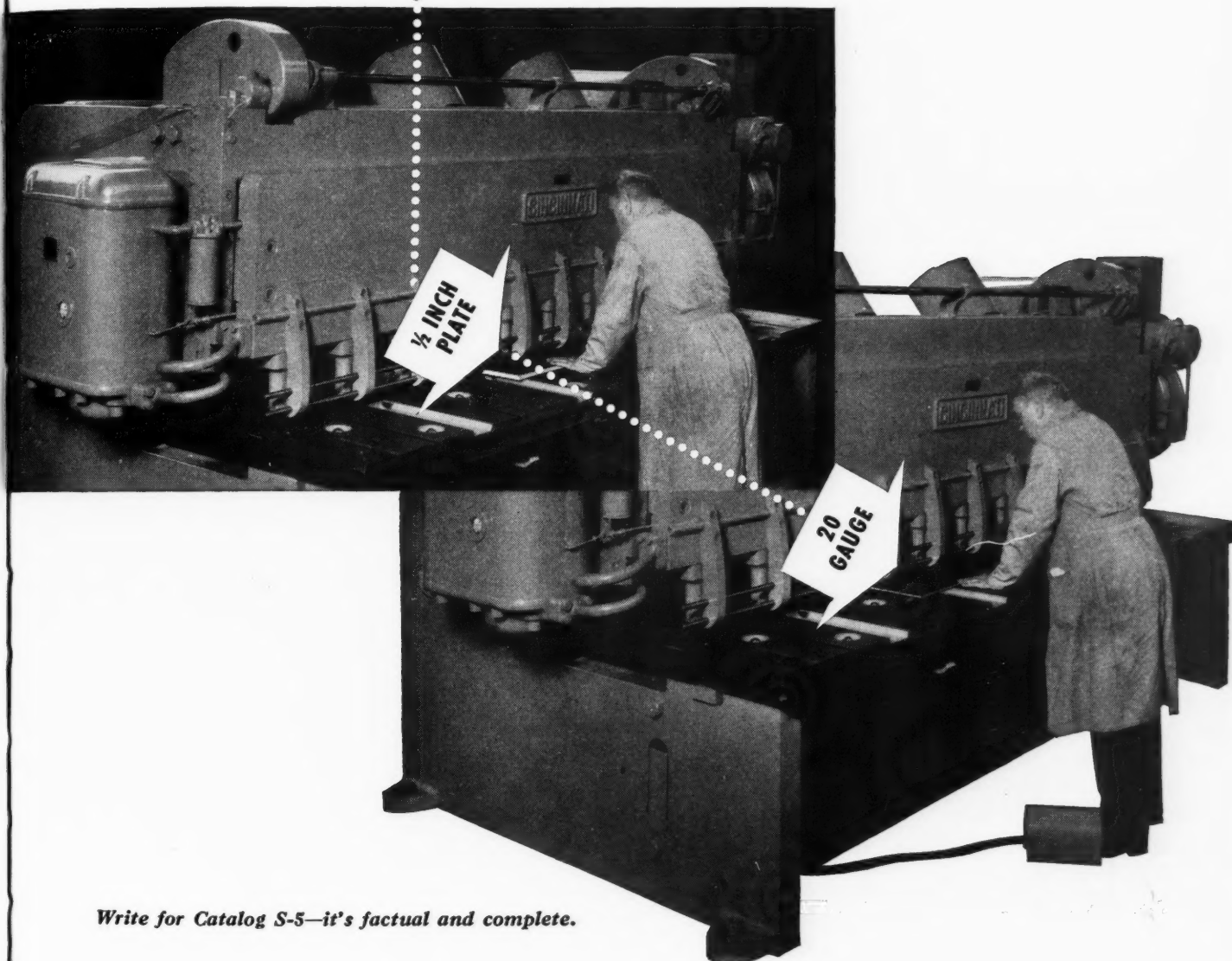
Shearing die attachment brought out by the Diamond Machine Tool Co., 3429 E. Olympic Blvd., Los Angeles 23, Calif., for the Model 3048 "Multi-Max" punch press. With this shearing die attach-

ment, the punch press can be converted into a 10-gage, 48-inch power squaring shear in approximately fifteen minutes. The shearing die attachment has adjustable front and back gages.121



To obtain additional information on equipment described on this page, see lower part of page 216.

SHEAR $\frac{1}{2}$ " PLATE OR 20 GAUGE SHEETS
without changing knife clearance
ON A CINCINNATI...



Write for Catalog S-5—it's factual and complete.

... You do not change knife clearance for successful shearing of different thicknesses on a Cincinnati. Just set the clearance for the thinnest material and shear all thicknesses up to capacity. Thousands of Cincinnati Shears are used continuously in this manner. This practical method prevents accidental damage—saves time. Remember, changing knife clearance interrupts production. Investigate the Cincinnati All-Steel Shear and its accurate, time-saving features.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES



"Hobby Tool" Hand Grinder

Light-weight, yet powerful, grinder known as the "Hobby Tool," brought out by the Dumore Co., Racine, Wis. This 1/40-H.P. tool weighs only 12 1/2 ounces, and runs on 115-volt alternating or direct current. Is especially



adapted for light bench and finishing work, touch-up work on dies and molds, chain saw sharpening, and general tool sharpening. Available in a steel box with fifty accessories, and in a standard kit with two accessories.122

Expanding Arbor with Kit of Interchangeable Work-Holding Cores

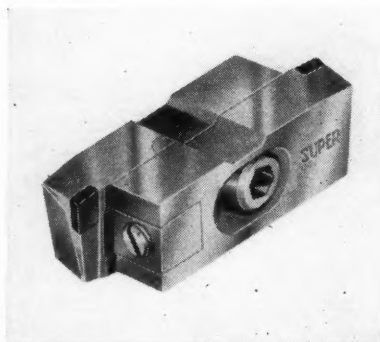
Expanding type of work-holding arbor known as "In-R-Tool," with kit of interchangeable cores and pressure members covering sizes from 1 1/4 to 2 3/4 inches. Can be used in chucks or collets or between lathe centers. Also adapted for holding work on drill presses and on the tables of milling



machines and other machine tools. Manufactured by the Layne-Held Corporation, 2005-F South Shelby St., Higginsville, Mo.123

Carbide Roughing Blade for Boring-Bars

New carbide-tipped expansion type roughing blade for boring-bars, announced by Super Tool Co., 21650 Hoover Road, Detroit 13, Mich. This

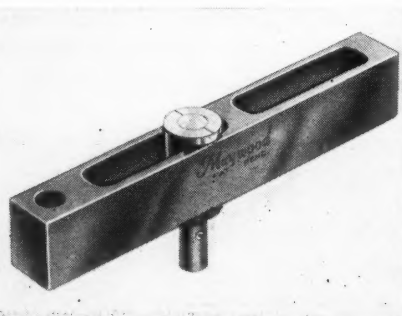
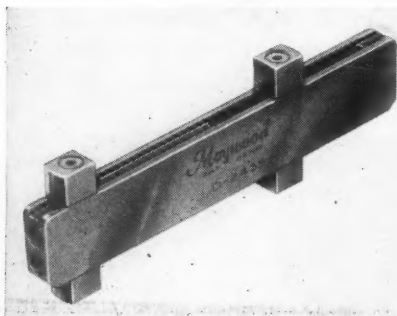


new roughing blade has the same range—up to 4 inches—as the expansion finishing blade recently announced by the company.124

Maywood Production Gages

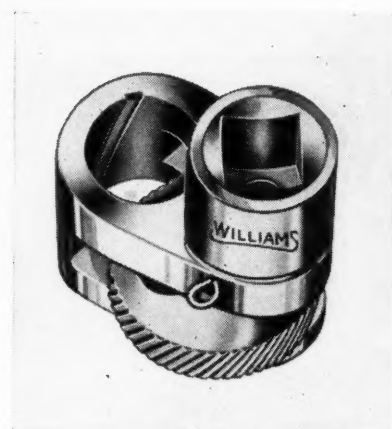
(Left) Double-duty production gage designed to combine in one unit adjustable members that can be independently set and locked in place for both the "Go" and "Not Go" sizes. The snap-gage range of 0 to 8 inches and the plug-gage range of 1 to 9 inches are covered by a series of five gages. (Right) Flush-pin gage designed for

adaptation to wide range of gaging operations. The gage pins can be adjusted 0.250 inch in the smaller sizes and 0.500 inch in the larger sizes. The range of 1/2 inch to 3 1/2 inches is covered by eight separate pin assemblies. Products of Maywood Industrial Engineering, 36 New Dwight St., Springfield, Mass.125



Williams Stud-Remover for Square Drive Handles

Stud-remover designed for use with 1/2-inch square drive handles and attachments. Is equally efficient for removing or setting studs. An eccentrically mounted roller with deep milled edge provides a non-slipping gripping



surface, which is non-burring. Stud capacity, 5/16 to 3/4 inch diameter. Made from alloy steel, heat-treated and chrome-plated. Product of J. H. Williams & Co., 400 Vulcan St., Buffalo 7, N. Y.126

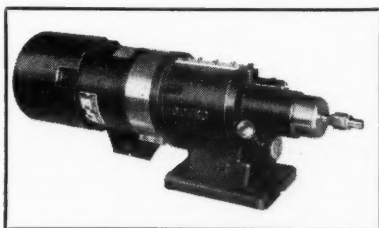


Respirator with Interchangeable Filters

Twin-cartridge respirator of new line developed to provide protection against seven respiratory hazards through a basic face-piece and seven interchangeable filters, announced by American Optical Co., Southbridge, Mass. The seven filters are designed specifically to protect workers against a combination of all dusts, organic vapors, acid gases, combined acid and organic gases, ammonia, a combination of organic vapors and dust, and fumes from metals heated to high temperatures.127

Govro-Nelson Automatic Drilling Unit

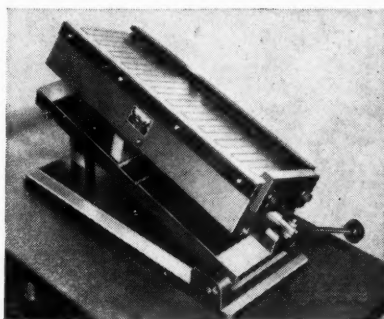
Automatic drilling unit with full hydraulic control, brought out by the Govro-Nelson Co., 1933 Antoinette St., Detroit 8, Mich. Feeding pressure of the new Model KH unit is derived from centrifugal force, and is accurately



controlled by hydraulic means. By simple adjustments, the rapid approach, rate of feed, and length of stroke can be changed as desired, thus adapting the unit to short-run, as well as long-run, production. Handles 1/32- to 1/4-inch tools with standard collet chuck, while tools up to 3/8 inch in soft materials can be handled with a special chuck.128

Magna-Sine Permanent-Magnet Chuck

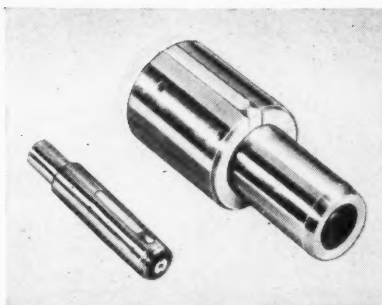
Magna-Sine permanent-magnet chuck designed for use on production type surface grinders. Has a chucking surface 7 1/2 inches deep by 20 1/2 inches long, and can be used for either wet or dry grinding. Can be quickly and accurately set up for either single-



or compound-angle work with standard gage-blocks by sine-bar method. Announced by Omer E. Robbins Co., 5722 Twelfth St., Detroit 7, Mich.129

Blade Contact Type Air Spindles for Precisionaires

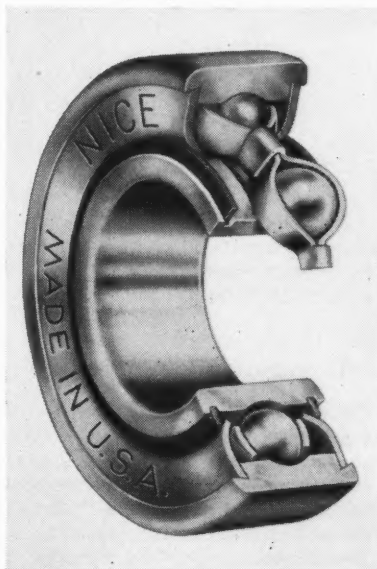
Blade contact type air spindles for column and dial type Precisionaires made by the Sheffield Corporation, Dayton 1, Ohio. These spindles enable instrument checking of the size, out-of-roundness, and taper of practically any hole, regardless of the finish or size. This equipment facilitates accurate



plotting of charts for quality control and can be made with one or more blades.130

"Composition-Sealed" Ball Bearing

"Composition-sealed" ball bearing of a new simplified design recently announced by the Nice Ball Bearing Co., Nicetown, Philadelphia, Pa. The com-



position-sealed feature consists of an oil-resistant, rubber-coated fabric in contact with a metal shield.131

Robbins & Myers Geared-Head Motors

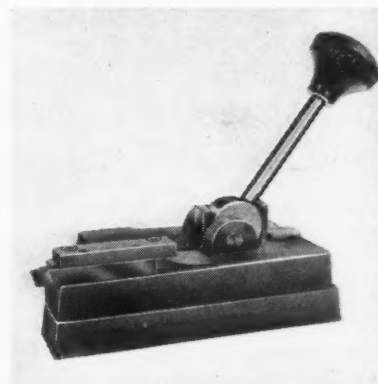
One of a new line of geared-head motors recently developed by Robbins & Myers, Inc., Springfield, Ohio, to



meet the requirements for a wide range of countershaft speeds. Basically a standard motor with a self-contained gear reduction mechanism. Available for single and double reduction in ratings from 1/200 to 1/3 H.P., with ratios from 6 to 1 up to 900 to 1, and in output torques from 1 to 500 inch-pounds. Countershaft speeds ranging from 833 to 8 r.p.m. permit the utilization of these motors in a wide variety of applications.132

Threading Tool for Lathes

Compact threading tool designed to fit the toolpost of any screw-cutting lathe. Can be furnished with boring-bar fixture



for cutting inside and outside threads. Tool bit is withdrawn at end of thread by a cam lock moved by the hand-lever. Bench lathe size weighs 2 1/4 pounds, and engine lathe size 13 pounds. Announced by Holkenbrink Machine Co., Sigel, Ill.133

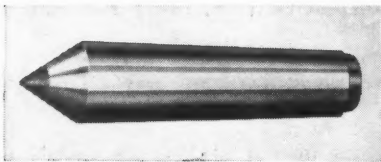


Automatic Coil Cradle for Punch Press

"Easy Load" automatic coil cradle developed by Rowe Tool & Die Co., 1506 N. Industrial Blvd., Dallas, Texas. Made in two sizes; the smaller model handles coil stock up to 36 inches outside diameter by 10 inches wide, while the larger model handles stock of the same width up to 40 inches outside diameter. Maximum speed of both is 90 feet per minute.134

To obtain additional information on equipment described on this page, see lower part of page 216.

MACHINERY, January, 1950—215

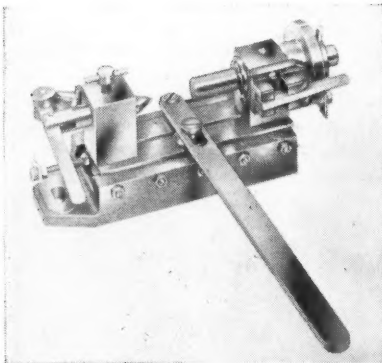


Carbide-Tipped Lathe Center

Lathe center with 60-degree tungsten-carbide tip, manufactured by the South Bend Lathe Works, 383 E. Madison St., South Bend 22, Ind., for use on lathes, grinders, and other machine tools. These centers are desirable for production jobs requiring high spindle speeds, long continuous cuts, and heavy roughing operations. Available with standard Nos. 2 and 3 Morse taper shanks.135

Rouse Collet-Holding Unit

New No. 9 collet-holding unit developed by H. B. Rouse & Co., 2214 N. Wayne Ave., Chicago 14, Ill., to permit spline-cutting, cutting pinions, squaring at angles, and many other operations on small work in the small sized Rouse hand miller, thus releasing larger machines for heavier work. The unit can also be employed as a jig on other machine tools.136



Sunnen Portable Honing Head

Portable honing tool for sizing and finishing holes, known as the "Honall." Can be used with a portable drill, a lathe, or a drill press for generating round, straight holes to an accuracy of 0.0001 inch and with a surface finish as fine as 2 micro-inches r.m.s. in hardened steel. The capacity of these tools



is for holes from 3/16 to 1 inch, in all metals, except lead and babbitt. Made by Sunnen Products Co., 7910 Manchester, St. Louis 17, Mo.137

Compound Angle Vise

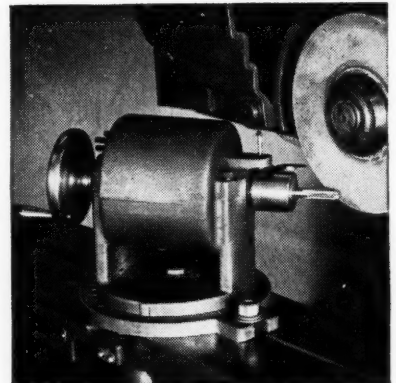
Compound angle vise for grinding, milling, and drilling at all angles. Can be converted from a swivel type vise to a straight drill vise by simply removing four cap-screws. The vise will hold parts up to 1 1/2 by 2 1/2 inches in size. The slotted base is 4 by 6 inches, and the over-all height of the vise, 6 inches.



The unit swings 180 degrees in either direction. Announced by En Fab, Inc., 338 Parsons St., Kalamazoo, Mich. 138

Tap Sharpener

New type of sharpener for taps announced by the Car-Arith Mfg. & Supply Co., St. Louis, Mo. This sharpener handles 2-, 3-, or 4-fluted taps with shank sizes up to 1/2 inch. Based on a new cam-operated principle, it will sharpen tap leads to the correct angle and with the correct amount of relief to assure clean cutting of threads. ..139



To Obtain Additional Information on Shop Equipment

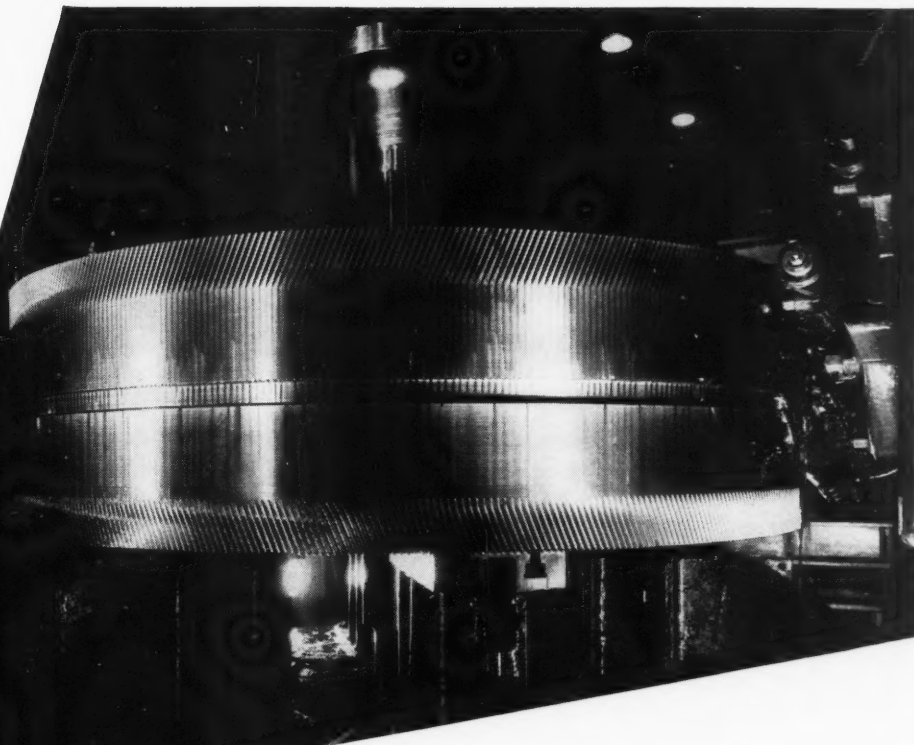
Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in January, 1950, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
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Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME..... POSITION OR TITLE.....
 [This service is for those in charge of shop and engineering work in manufacturing plants.]
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Falk gear shown being cut is 15 feet in diameter, has a 42-inch gear face. Coolant used on hobs is *Texaco Sultex Cutting Oil*. No machining job is too big . . . or too small . . . for Texaco.



ACCURACY
to
.0001"

Falk keeps hobs sharp with **TEXACO SULTEX CUTTING OIL**

Picture shows first cut — about a 5-day job — on a giant Falk double helical reduction gear. On finish cut — a non-stop, 72-hour operation — *the two hobs must not change dimensions 1/10,000 of an inch!* If they do, the big gear will have to be recut. Hobs *must* stay sharp.

Texaco Sultex Cutting Oil is used here . . . and on hundreds of other difficult machining jobs . . . because of the effective way it lubricates the hob . . . keeps tool and work cool . . . prevents chip welding . . . assures better surface finish.

Texaco Sultex Cutting Oil is but one of a complete line of Texaco cutting, grinding and soluble oils . . . designed to assure longer tool life and better, faster machining whatever the metal or the method of cutting it.

Let a Texaco Lubrication Engineer, specializing in cutting coolants, help you improve machining efficiency and reduce costs. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.



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New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 222 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the January, 1950, Number of MACHINERY

Bronze and Copper Bearings and Castings

AMERICAN BRAKE SHOE CO., NATIONAL BEARING DIVISION, 4930 Manchester Ave., St. Louis 10, Mo. Catalogue containing twenty-eight pages of data on twenty-seven bronze alloys, five aluminum and manganese bronzes, and various babbitt metals, together with an outline of typical applications. 1

Non-Ferrous Castings

HOWARD FOUNDRY CO., 1700 N. Kostner Ave., Chicago 39, Ill. Catalogue containing 72 pages on the aluminum, magnesium, brass, bronze, and other non-ferrous castings made by the company. Information is included on the fabrication of these alloys for jet and turbine engine parts, as well as data on casting methods, properties, chemical analyses, etc. 2

Standard Measuring Machines

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford 1, Conn. Circular 523, illustrating and describing the Pratt & Whitney standard measuring machine with controlled measuring pressure, designed to check gages, tools, and workpieces to an accuracy of 0.00001 inch. 3

Non-Ferrous Alloy Handbook

RIVERSIDE METAL CO., Riverside, N. J. 44-page pocket-size handbook containing information of value in selecting and ordering non-ferrous alloys. Applications, composition, forms, properties, and manufacturing limits of the alloys produced by this company are specified. 4

Ball Bearings for Conveyor Systems

NEW DEPARTURE, DIVISION GENERAL MOTORS CORPORATION, Bristol, Conn. Booklet illustrating and describing five different types of New Departure self-sealed and lubricated-for-life ball bearings designed for use on conveyor systems and similar applications. 5

Drawing Compounds for Metals

ESSO STANDARD OIL CO., 15 W. 51st St., New York 19, N. Y. Lubertext D239-J2, containing detailed recommendations for selecting cold and hot drawing compounds for use on various ferrous and non-ferrous metals in stamping, forming, wire-drawing, tube-bending, extrusion, etc. 6

Hydraulic Oils

HYDRAULIC EQUIPMENT CO., 1100 E. 222nd St., Cleveland 17, Ohio. Bulletin SO, containing a list of the products of representative oil companies suitable for use in Hydreco oil-hydraulic systems, together with technical data on their viscosity, pour point, and flash point. 7

Lubricant Application Guide

KEYSTONE LUBRICATING CO., Twenty-first and Lippincott Sts., Philadelphia 32, Pa. Lubricant Application Guide (Form C10L) containing recommendations for lubricating all types of bearings under various operating conditions. 8

Electronic Controls

PHOTOSWITCH, INC., 77 Broadway, Cambridge 42, Mass. Bulletin entitled "Cutting Production Costs with Electronic Controls,"

descriptive of forty-five case studies showing savings effected by the use of photo-electric and electronic controls. 9

Shielded-Arc Welding

LINCOLN ELECTRIC CO., Cleveland, Ohio. Bulletin 439, describing the "Lincolnweld" new automatic shielded-arc welding process, including correct procedure for making different types of welds, equipment employed, and typical installations. 10

Machine and Tool Accessories

GEORGE F. BUB & SON, 6007 Bradley Ave., Cleveland 9, Ohio. Catalogue 50, describing the complete line of machine and tool accessories made by the company, including handwheels, clamping levers, machine handles, screws, locating keys, washers, etc. 11

Electric Motor Lubrication

TEXAS CO., 135 E. 42nd St., New York 17, N. Y. January, 1950, number of *Lubrication* containing an article on electric motor lubrication, including complete information on the lubrication of ball bearings, roller bearings, and sleeve type bearings. 12

Vibration Test Machines

L.A.B. CORPORATION, 31 Union Place, Summit, N. J. Circular describing two types of two-dimensional, reaction type, vibration test machines of semi-portable design, requiring no concrete base, having capacities for loads up to 500 pounds. 13

Automatic Press-Room Equipment

U. S. TOOL COMPANY, INC., Ampere (East Orange), N. J. Bulletin 70, describing U. S. automatic press-room equipment, including slide and roll feeds, straighteners, stock reels, coil cradles, oilers, and wipers.14

Carbide Dies

CARBOLOY COMPANY, INC., 11147 E. Eight Mile Blvd., Detroit 32, Mich. Supplement D-3 to the company's general die catalogue D-126, describing improved features of the standard round-hole carbide dies for drawing wire, bars, and tubing.15

Foot Shears

NIAGARA MACHINE & TOOL WORKS, 637 Northland Ave., Buffalo 11, N. Y. Bulletin 80F-A, illustrating and describing the company's complete line of all-steel foot shears, designed to combine strength, stiffness, lightness and portability.16

Electric-Eye Flame-Cutting

JOSEPH T. RYERSON & SON, INC., Box 8000-A, Chicago 80, Ill. Bulletin describing electric-eye flame-cutting, showing intricate and unusual steel shapes cut to customer's order by the company's new electric-eye flame-cutting equipment.17

Universal Broaching Machines

COLONIAL BROACH CO., Box 37, Harper Station, Detroit 13, Mich. Technical bulletin RP-49, describing the design features and giving complete data on the new Colonial line of low-cost, universal, ram type, hydraulic broaching machines.18

Radiant Gas Heating Machines for Forging and Bending

SELAS CORPORATION OF AMERICA, Erie Ave. and D St., Philadelphia 34, Pa. Bulletin S-6.1, describing the advantages of heat processing machines for forging and bending, and illustrating typical installations.19

Horizontal Boring, Drilling, and Milling Machine Attachments

CINCINNATI GILBERT MACHINE TOOL CO., 3366 Beekman St., Cincinnati 23, Ohio. Bulletin 749, on accessories and attachments for

all types of Gilbert horizontal boring, drilling, and milling machines.20

Geared-Head Lathes

AMERICAN STEEL FOUNDRIES, KING MACHINE TOOL DIVISION, Cincinnati 29, Ohio. Catalogues S-1 and S-101, illustrating and describing Sebastian standard Type R geared-head lathes and special Type R geared-head lathes, respectively.21

Speed Reducers

FOOTE BROS. GEAR & MACHINE CORPORATION, 4545 S. Western Blvd., Chicago 9, Ill. Engineering Manual MPA, on the company's new line of "Maxi-Power" enclosed helical gear drives, in single, double, and triple reduction types.22

Tool and High-Speed Steels

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh 22, Pa. Booklet entitled "The Working of Tool and High-Speed Steels," giving properties, selector chart, machining procedures, tool design, heat-treatment, grinding, etc.23

Automatic Thread Roller

HARTFORD SPECIAL MACHINERY CO., Hartford 5, Conn. Bulletin TR-100, describing the features of construction of the Hartford special automatic thread roller, designed for production runs on all types of small screws.24

Tapping Heads

PROCUNIER SAFETY CHUCK CO., Department 14, 18 S. Clinton St., Chicago 6, Ill. Circular entitled "Taps Last Longer," descriptive of the Procunier line of cover clamping tapping heads and accessories.25

Speed Reducers

EUCLID UNIVERSAL MACHINE, INC., 15002 Woodworth Road, Cleveland 10, Ohio. Catalogue 202, covering the Euclid line of universal speed reducers, including charts of torque and input horsepower ratings.26

Push-Broaches

KASE MACHINE CO., 18429 Buffalo Ave., Cleveland 19, Ohio. Catalogue 12, describing the complete line of Glenny push-broaches and eccentric adapters. Operating and

engineering data, specifications, and prices are included.27

Oxy-Acetylene Shape-Cutting Machine

AIR REDUCTION, 60 E. 42nd St., New York 17, N. Y. Booklet descriptive of the Airco No. 3 "Monograph," a new low-priced portable oxy-acetylene shape-cutting machine.28

High-Speed Precision Machines

HARDINGE BROTHERS, INC., Elmira, N. Y. Bulletin SMP, describing cost-reducing applications of Hardinge high-speed precision machines in screw machine production.29

Hydromatic Milling Machines

CINCINNATI MILLING MACHINE CO., Cincinnati 9, Ohio. Catalogue M-1670, describing and illustrating Cincinnati Hydromatic plain and duplex milling machines. Complete specifications are included.30

Drill Jig Bushings

COLONIAL BUSHINGS, INC., P.O. Box 37, Harper Station, Detroit 13, Mich. Catalogue B-649, presenting all vital dimensions and information on standard drill jig bushing or liners, conveniently arranged for quick reference.31

Precision Die Sets

UNION MFG. CO., New Britain, Conn. Circular containing complete specifications, including price list, for Union "Ultra-Precision" die sets, made to conform to the proposed standards set up by the A.S.M.E.32

Silent Chain Drives

WHITNEY CHAIN & MFG. CO., Hartford 2, Conn. Catalogue SCS-49, descriptive of Whitney silent chain drives for applications ranging from fractional to over 50 H.P. Stock drive selection tables are included.33

High-Speed Reamers

HASLEY PRODUCTS CO., 29706 Grand River Ave., Farmington, Mich. Leaflet describing the "Status-Quo" high-speed reamers, which have high-speed steel blades secured to a low-carbon steel body by a rolling process.34

Surface Pyrometer

PYROMETER INSTRUMENT CO., INC., Bergenfield, N. J. Catalogue 180, illustrating and describing a new inexpensive pyrometer for accurately determining surface and sub-surface temperatures in industrial plants or laboratories. 35

Inclinable Presses

VERSON ALLSTEEL PRESS CO., 9309 S. Kenwood Ave., Chicago 19, Ill. Bulletin OBI-49, describing the design features of Verson open-back inclinable presses ranging from 90 to 250 tons. 36

Coil-Form Clamps

HUNTER SPRING CO., 1 Spring Ave., Lansdale, Pa. Bulletin 310-1C, entitled "Neg'ator Clamps for Industry," describing a new coil-form clamp with automatic take-up, and applications. 37

Vertical Filing Systems

ATLAS STENCIL FILES CO., 1662 E. 118th St., Cleveland 6, Ohio. Circular describing the Atlas vertical filing system for filing stencils, blueprints, tracings, X-ray films, etc. 38

Industrial Marking Devices

AMERICAN CRAYON CO., 388-488 Hayes Ave., Sandusky, Ohio. Industrial Crayon Guide, designed to aid in the selection of industrial markers for various kinds of surfaces and conditions. 39

Flexible Shafting

ELLIOTT MFG. CO., 95 Prospect Ave., Binghamton, N. Y. Circular

4a, describing power-drive and remote-control types of flexible shafting, as well as push-pull controls. 40

Grinders

MATTISON MACHINE WORKS, Rockford, Ill. Catalogue 190, containing complete information on the Hanchett line of surface grinders now made and sold by the Mattison Machine Works. 41

Electric Blowers

BUFFALO FORGE CO., Buffalo 5, N. Y. Bulletin 3014-D, on Buffalo Types E and RE electric blowers and exhausters for use in shops where air is required for oil or gas furnaces. 42

Gun Drills

NATIONAL TWIST DRILL & TOOL CO., Rochester, Mich. Circular describing the outstanding features of "Target" gun drills, developed especially for deep-hole drilling. 43

Portable Electric Tools

INDEPENDENT PNEUMATIC TOOL CO., Aurora, Ill. Catalogue E-2, covering the entire line of Thor universal electric portable power tools, including the new Silver Line belt sanders. 44

Jobbing Work

HARDINGE MFG. CO., (formerly Steacy-Schmidt Mfg. Co.) 240 Arch St., York, Pa. Bulletin AS-400, illustrating and describing the company's facilities for doing jobbing work. 45

Motors

GENERAL ELECTRIC CO., Schenectady 5, N. Y. Bulletin GEA-5401, illustrating and describing the new "Tri-Clad" single-phase capacitor motor. 46

Decimal-Equivalent Chart

DAYTON ROGERS MFG. CO., 2830 S. 13th Ave., Minneapolis 7, Minn., is distributing a combination decimal-equivalent chart and 1950 calendar. 47

Dial-Indicator Contact Points

PRECISION SUPPLY & MACHINE CO., 1 E. 42nd St., New York 17, N. Y. Leaflet descriptive of sapphire- and carbide-tipped dial-indicator contact points. 48

Bench Shapers

SOUTH BEND LATHE WORKS, South Bend 22, Ind. Bulletin 500, descriptive of the new South Bend 7-inch bench shaper. 49

Abrasive Snagging Wheels

MID-WEST ABRASIVE CO., Owosso, Mich. Folder illustrating and describing Mid-West fiber-cushioned snagging wheels. 50

Wear-Resistant Electrodes

ALLOY RODS CO., York, Pa. Bulletin 10849, announcing a new chrome-boride "Wear-Arc" electrode for hard surfacing. 51

Twist Drills

UNION TWIST DRILL CO., Athol, Mass. New price list on taper-shank, straight-shank, and other twist drills. 52

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (January, 1950) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
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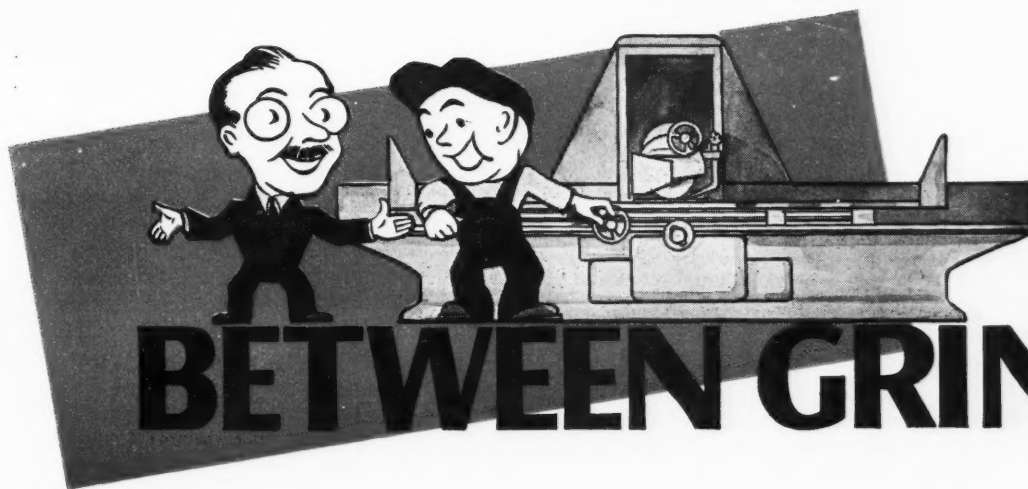
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[This service is for those in charge of shop and engineering work in manufacturing plants.]

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By E. S. Salichs

The Old Story, or Which Came First

A letter was received from the Utopia College of Industrial Administration in Eureka, Kan., inquiring about the availability of models of machine tools. What we want to know: Did the Utopians shout, Eureka!—or did the Eurekaans shout, Utopia!

The Seven Noises of Truck

Service engineers of the GMC Truck and Coach Division have finished a study of noises made by vehicles in distress and have reduced them to seven basic sounds—squeak, rattle, thump, grind, knock, scrape, and hiss. The idea is for drivers to learn to recognize exactly the sounds they have observed, thus helping mechanics to diagnose quickly the trouble. For anyone who wants to practice distinguishing the various sounds as codified above, a jaunt in practically any New York subway is recommended. Here one can put one's ear to the underground and listen to

the pure strains of the squeak, rattle, thump, grind, knock, scrape, and hiss.

"Pedia" is Good-Will Media

Last month Acme Industries, Inc., Jackson, Mich., ordered fifty sets of our "Engineering Encyclopedia" (two volumes) gift-wrapped for Christmas.

Tanner Rating

Some time ago our Editor received a heartwarming letter from H. S. Tanner, managing director of Tanner Trailers Ltd., Auckland, New Zealand, manufacturer of drilling and boring machines, wood lathes, etc. It would have been unworthy to bury his kind opinion of us in the files, and so we wrote to Mr. Tanner asking permission to reprint the letter on this page, which was granted. Mr. Tanner: "We received the July issue of MACHINERY last week, and since it was received, the writer has personally gone through every page from cover to cover. He

must compliment you on the valuable and useful information this particular issue contained. Your company, and no doubt you yourself, must have gone to considerable trouble to produce this very fine issue. Every monthly issue of your book is read from cover to cover, and we regard your magazine as the most advanced and helpful of any technical engineering journal we receive. We purchase, through our book representatives, every good technical magazine published in the English language, exceeding each month some sixty to seventy copies, dealing with engineering, foundry, and product finishing and related subjects. We would like to state that we value yours above any other magazine. Many thanks for the information we have received and the excellent printing which is so much enjoyed by us."

Massa's in Metal

Recently we replied to a correspondent whose address was Old Brass Plantation, Yemassee, S. C.

ONE OF OUR YOUNGER CONTRIBUTORS—

J. R. Paquin, born and brought up in Lowell, Mass., completed his engineering studies at the Lowell Textile Institute in 1940 and started right in on tool conversion to war work at the General Electric Co. This proved to be a warming-up period, for by 1942 he was in the uniform of a staff sergeant in charge of Air Force machine shops at various fields, designing and developing, for example, special tools for the first production line maintenance system installed by the Air Forces, and later adopted by all United States air installations. In 1944, a civilian again, he developed tooling for the XF-12 (Rainbow) and P-84 jet plane at the Republic Aircraft Corporation. Other



Photo Loring Studios

associations followed, and then Mr. Paquin became a tool engineering consultant located at Hartford, Conn., as well as a writer of technical articles (see December MACHINERY, "Design of Hoppers for Automatic Machines," and "Design of Internal Broaches," page 165 of this issue). He is a member of the American Society of Tool Engineers. Mr. Paquin's hobbies include photography and salt water fishing. His biggest catch occurred just before the Army threw out its line, and consisted of a 15-pound striped bass. But that is old fish, and Mr. Paquin intends to wangle enough leisure this summer to wiggle a specimen onto his hook that will better his record—a large photogenic fish!

Grinding Buick Flywheels for Crankshaft Assembly

A simple set-up employed by the Buick Motor Division of the General Motors Corporation for grinding a ring-shaped surface on a flywheel preparatory to assembling it to its crankshaft is shown in the accompanying illustration. The flywheel has a hot-rolled steel body to which a ring gear is brazed.

The finishing of the surface surrounding the hole at the center of the flywheel, to which the crankshaft is to be bolted, was made somewhat more difficult by the addition of the ring gear. This surface was finished to the high degree of accuracy required, however, by holding the work in a fixture that is mounted on a 16-inch rotary surface grinder built by the Arter Grinding Machine Co., Worcester, Mass.

The special fixture, designed by the Buick Co., has a series of six pins that are slightly smaller in diameter than six of the holes near the rim of the flywheel body. Close to the top end of each pin is an inclined notch. The flywheel to be ground is dropped over the six pins and rotated slightly, so that the thin wall body section will enter the notches in the pins. The inclined notches serve to force the work-piece down on the locating blocks.

After the work has been loaded in the chuck, the operator simply presses the cycle starting button. The hydraulically operated ma-

chine then automatically brings the grinding wheel over the section to be ground, elevates the work to the grinding position, and engages a slow-feed table-elevating screw, which results in finish-grinding the work with a plunge cut. The position of the revolving grinding wheel does not change during the plunge cut. The depth of the plunge cut is determined by a positive stop, and a time delay switch provides a dwell at the end of the cut.

As soon as the plunge cut is completed, the table is automatically lowered and the grinding wheel returned to the starting position, where it is slowed down to a wheel dressing speed. The wheel is then automatically fed back across the truing diamond and forward again, stopping automatically in the proper position to repeat the grinding and truing cycle.

The work-table on which the diamond is held is automatically raised 0.001 inch before each pass of the wheel over the point of the truing diamond. The diamond point is set in a fixed relationship with a reference surface that determines the finished thickness of the work.

* * *

During the 1940's, about 800,000,000 tons of steel were made—the steel industry's greatest decade.

Radial Engine Drives Electric Generator

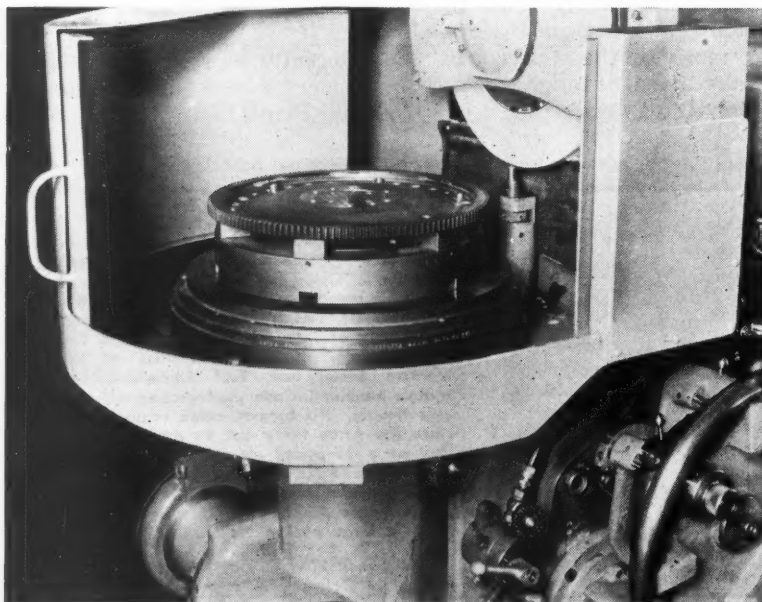
A vertical-shaft radial engine burning natural gas or oil has been combined with a vertical generator that supplies both direct and alternating current, producing a unique engine-generator. The Aluminum Co. of America has installed 120 such machines to provide low-cost power for aluminum production.

The engines, built by the Nordberg Mfg. Co., are of the two-cycle type, with eleven 14- by 16-inch cylinders arranged radially in a horizontal plane. The maximum rating at the required speed of 360 R.P.M. is 1800 H.P., but the engine can deliver this power at speeds up to 400 R.P.M.

The Westinghouse Electric Corporation is building forty of the generators, which have a direct-current rating of 1100 K.W. at 645 volts, and an alternating-current rating of 150 K.W. at 450 volts, 24 cycles, three-phase. The direct current, taken from a commutator, is to be used in aluminum processing. The alternating current, taken from collector rings, is for engine auxiliaries.

* * *

Weights of steel balls for bearings vary from 7000 to the ounce to several pounds apiece for heavy-duty applications. At the war-time peak, 120,000 tons of steel a year were consumed in the production of ball bearings.



Buick flywheel held in special fixture on rotary surface grinder for finishing the ring-shaped surface around the center hole to which the crankshaft is to be bolted

News of the Industry

Illinois

MATHEWS DICK, JR., has recently been appointed sales engineer in the Chicago area for the Butterfield Division of the Union Twist Drill Co., Derby Line, Vt., manufacturer of taps, dies, reamers, and special metal-cutting tools. He was previously employed in the machine shop and time study department of the International Harvester Co.

C. E. BRADY has been appointed general sales manager of the Power Tool Division of the Duro Metal Products Co., Chicago, Ill., manufacturer of precision tools.

Michigan

GEOFFROY CO., P. O. Box 67, Capitol Hill Station, Denver 6, Colo., has been appointed sales engineering representative for the COLONIAL BROACH CO., Detroit, Mich., manufacturer of broaches, broaching machines, sharpening equipment, hydraulic presses, and allied equipment.

GENERAL ELECTRIC CO., Schenectady, N. Y., announces that it has transferred the responsibility for all metallurgical manufacturing, sales, and engineering to the CARBOLLOY COMPANY, INC., Detroit 32, Mich.

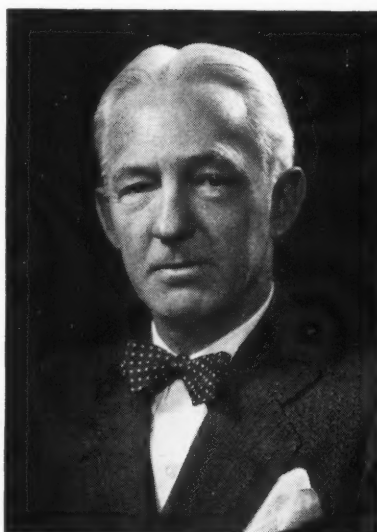
ALEX HUNTER, manager of the Ypsilanti, Mich., plant of the Ford Motor Co., has been appointed plant manager of the company's newly acquired unit at Monroe, Mich.

New England

F. H. HARRIS CO., 340 Main St., Worcester 8, Mass., has been appointed service and sales representative for the line of gear cutting and finishing machines, gear-cutting tools, and gear-checking equipment made by the MICHIGAN TOOL CO., Detroit 12, Mich., as well as for the line of broaches, broaching machines, hydraulic presses, and other equipment made by the COLONIAL BROACH CO., Detroit, Mich.

ARTHUR J. RENZ has been named field engineer on precision spindle applications for the Pope Machinery Corporation, Haverhill, Mass. Prior to his present connection, Mr. Renz was with the General Electric Co. in the tool and die department.

HAROLD B. SCHOTT has been appointed director of sales promotion for the Brown & Sharpe Mfg. Co.,



© Fabian Bachrach

Harold B. Schott, recently appointed director of sales promotion for the Brown & Sharpe Mfg. Co.

Providence, R. I. Mr. Schott was formerly in charge of sales of the Pump Division.

CLAYTON R. BURT, an outstanding figure in the machine tool industry, celebrated his seventy-fifth birthday on December 17. Upon the occasion, congratulations and best wishes poured in on him from his many friends throughout the United States and other parts of the world. Mr. Burt was born in Lynn, Mass., and



Clayton R. Burt, president of Potter & Johnston Machine Co., who recently celebrated his seventy-fifth birthday

began his career as an apprentice with the Brown & Sharpe Mfg. Co. of Providence, R. I., advancing rapidly to positions of high responsibility. He is now president of the Potter & Johnston Machine Co., Pawtucket, R. I., recently acquired by the Niles-Bement-Pond Co., Hartford, Conn., of which Mr. Burt was formerly president and chairman of the board. Several parties were given in his honor by foremen of the Pratt & Whitney Division and by officials of the Niles-Bement-Pond Co. Mr. Burt is also a director of leading financial and industrial corporations in the Hartford area, and yet finds time to take an active part in civic and community affairs.

READY TOOL CO., Bridgeport, Conn., has recently acquired all patent, manufacturing, and sales rights to the Barter-Ritco reversible grinder dog formerly manufactured by the RHODE ISLAND TOOL CO., Providence, R. I. Facilities for manufacturing this product will be transferred to the Ready plant in Bridgeport.

New York

DR. ZAY JEFFRIES, vice-president of the General Electric Co., Schenectady, N. Y., in charge of the Chemical Department, retired from the company on December 31. During the war, Dr. Jeffries was vice-chairman of the War Metallurgy Committee and chairman of two of its subcommittees. He also served as consultant for the University of Chicago's metallurgical laboratory, part of the Manhattan Project for research and development work on the atomic bomb. Dr. Jeffries has been a member of General Electric's four-man committee which administers the Nucleonics Project, consisting of all work on atomic energy being conducted by the company for the Government. He began service with the company in 1914 as a consultant to the National Lamp Works. From 1932 to 1936 he was also president of the Carboloy Company, Inc., a General Electric affiliate, and since then has been a member of the board. He has received many medals for his achievements in the chemical and metallurgical fields.

F. P. TAUGHER has been made manager of engineering for the Industrial Control Division of the Westinghouse Electric Corporation at Buffalo, N. Y. For the last five years, he has been engineering and service manager in the company's New England district, where he will be suc-

ceeded by M. L. GARDNER. Mr. Gardner's headquarters will be in Boston, Mass.

W. E. LUNGER, district manager of the Huntington, W. Va., plant of the American Car & Foundry Co., has been appointed assistant vice-president in charge of production, with headquarters at 30 Church St., New York 8, N. Y. J. E. KOONTZ, assistant district manager, succeeds Mr. Lunger at Huntington.

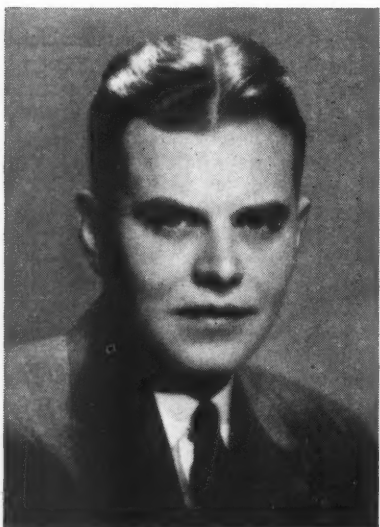
UNION TWIST DRILL Co., Athol, Mass., manufacturer of carbide, carbon and high-speed steel cutting tools, has announced the appointment of MACHINISTS TOOLS, INC., 854 Main St., Buffalo, N. Y., as distributor for the company in Buffalo and the surrounding territory.

SIMONDS ABRASIVE Co., Philadelphia, Pa., manufacturer of grinding wheels and abrasive grain, announces the appointment of VAN KLEECK-WILSON, INC., 29 Wilkeson, Buffalo 2, N. Y., as distributor of its products in the Buffalo area.

J. O. CLEVINGER has been made manager of the welding department of the Westinghouse Electric Corporation, at Buffalo, N. Y., and J. P. COUGHLIN has been made manager of field sales.

D. S. MACDONALD has been made assistant to the manager of the Gear Motor Sales Division of the General Electric Co., Schenectady, N. Y.

MORSE G. DIAL, vice-president and treasurer of the Union Carbide and Carbon Corporation, New York City, has been elected a director. KENNETH H. HANNAN has been elected secretary to succeed Mr. Dial, who has held that position since 1945.

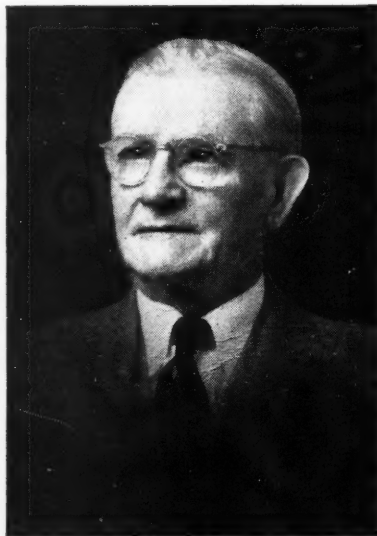


Morse G. Dial, recently elected a director of Union Carbide and Carbon Corporation

Ohio

E. W. BLISS Co., Toledo, Ohio, announces the appointment of the following new sales representatives: STEDFAST & ROULSTON, INC., Boston, Mass.; LAKESHORE MACHINERY & SUPPLY Co., Muskegon, Mich.; WILLIAM S. BOLDEN Co., INC., Charleston, W. Va.; CORRY'S MACHINE & TOOL, INC., Davenport, Iowa; and ELLFELDT MACHINERY & SUPPLY Co., Kansas City, Mo.

W. H. KLOCKE has been appointed consulting engineer for the Cleveland Punch & Shear Works Co., Cleveland, Ohio. Mr. Klocke has had a wide experience in the power press field, gained through fifty-six years of association as chief engineer and consulting engineer with one of the largest press manufacturers. He is



W. H. Klocke, consulting engineer for Cleveland Punch & Shear Works Co.

responsible for inventing and developing the double-action toggle press used in the production of automobile fenders, bodies, and cowl, as well as special presses for stamping chassis frames.

MORRISON INDUSTRIES, INC., 2976 Manchester Road, Cleveland 22, Ohio, has been organized by a group of men with long experience in the oven, furnace, and wire equipment field to offer engineering, construction, and installation service on industrial ovens and furnaces, conveyor systems, wire drawing machines, etc. JOHN R. MORRISON is president of the new concern.

FRANK D. MUMFORD has been appointed parts sales manager of the E. W. Bliss Co., Toledo, Ohio, maker of stamping presses, rolling mills, and container machinery. He will



Frank D. Mumford, recently appointed parts sales manager of E. W. Bliss Co.

be in charge of the company's newly established program to improve parts replacement and service for its line of presses throughout the country. Mr. Mumford has been engaged in parts engineering and sales work for the Toledo Division of the company during the last twenty-three years.

FAWICK AIRFLEX Co., Cleveland, Ohio, manufacturer of industrial clutches, announces a number of changes in its sales and engineering department: JOHN V. EAKIN has been named assistant sales manager; J. S. WALSH, assistant chief engineer; FRANK C. WARTH, southwestern district manager, with offices at Fort Worth, Tex.; and C. H. LAY, Chicago district manager, with offices at Evanston, Ill. J. B. KELLEY, who was formerly director of sales and engineering, is no longer connected with the company.

SIZE CONTROL Co. and WALSH PRESS & DIE Co., divisions of AMERICAN GAGE & MACHINE Co., have recently opened new offices at 3344 W. 105th St., Cleveland, Ohio, with HUGH G. COLLINS and WALLACE W. DENHOFF in charge. The Size Control Co. has also announced the appointment of JOSEPH A. BATTLE & Co. as metropolitan New York representative.

Pennsylvania and Maryland

OMAR V. GREENE has been appointed New England sales manager, with headquarters in Hartford, Conn., for the Carpenter Steel Co., Reading, Pa. Mr. Greene succeeds WYNN F. ROSSITER, who has been made assistant to the vice-president and will devote his time to special work. JOHN W. THOMPSON, formerly manager of alloy steel sales, has been named man-

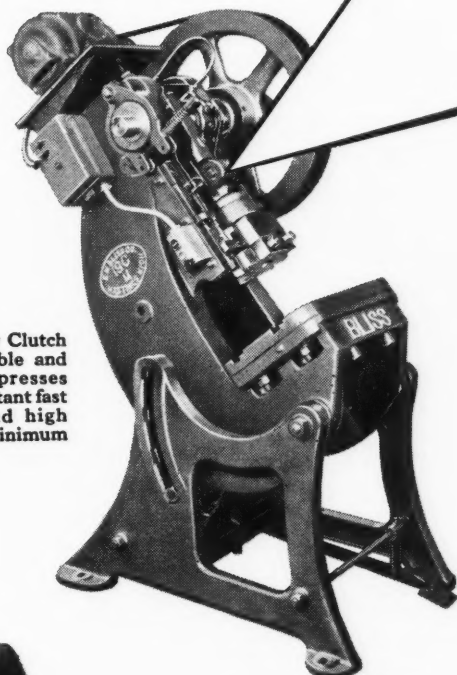
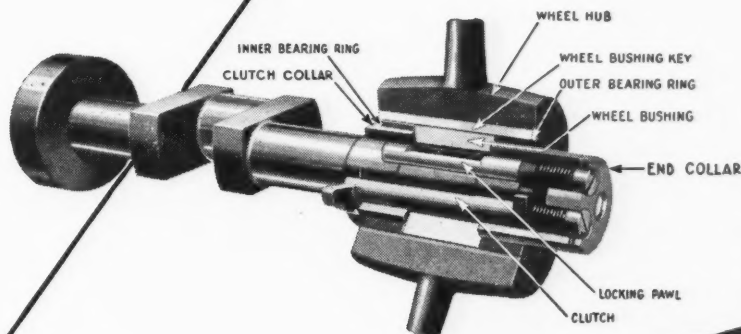
Why Press Users Call the Bliss Rolling Key Clutch

"The Most Dependable Positive Clutch Available"

In these illustrations, you see some of the engineering features that have made the Bliss Rolling Key Clutch the most specified and widely used press clutch on production lines everywhere.

The proof-in-operation is being demonstrated by the performance of thousands of these clutches in Bliss Inclined and Straight Side presses. Here, the ruggedness and precision that are built into the Rolling Key Clutch assure consistent efficiency, even under the most severe stamping conditions . . . year after year. And its fast-engaging action keeps pace with high-speed requirements.

No other positive mechanical clutch offers the combination of advantages enumerated on this page.



The Rolling Key Clutch on Bliss Inclined and Straight Side presses provides for constant fast engagement and high speed with a minimum of attention.

1. CAN BE ENGAGED MORE FREQUENTLY OVER LONGER PERIODS OF TIME. The clutch keys—set close to the axis of the shaft—"roll" into instant, complete engagement without "side kick" on the flywheel. Four engaging positions assure quick, smooth starting, resulting in more working strokes per minute.

2. POSITIVE MECHANICAL ACTION TRANSMITS ALL THE FLYWHEEL ENERGY DIRECTLY TO SHAFT WITHOUT POWER LOSS.

3. PEAK EFFICIENCY AT HIGH SPEED. Rugged, oversize clutch keys take driving load as thrust, not shear—give smooth, sure action.

4. NO SLIPPAGE, NO STICKING. Crankshaft is locked to wheel in both directions; yet either or both keys are easily locked out for die setting or "bumping" press.

5. CAN BE SET FOR SINGLE STROKE, CONTINUOUS OR AUTOMATIC OPERATION—MECHANICAL OR AIR OPERATED. Latch bracket action is at right angles to clutch—cannot be forced aside. Disengagement is complete and entirely spring cushioned.

6. EASY MAINTENANCE. Wear is kept to a minimum by even distribution of bearing load. All wearing parts are readily replaced.

7. LUBRICATION. Minimum lubrication is necessary with use of oilless bearings.

These features sum up why press users call the Bliss Rolling Key Clutch "The most dependable positive clutch available," and credit it as one of the major reasons why they continue to specify BLISS Inclined and Straight Side presses.

Write Today for This New Bliss Literature

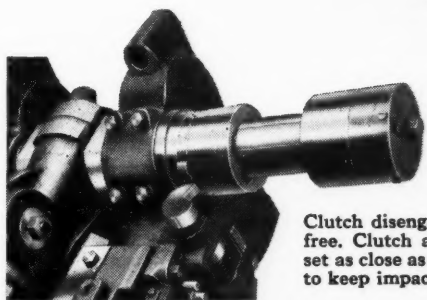
Inclined Press Catalog 2-C

Inclined Press Service Sheet A-105

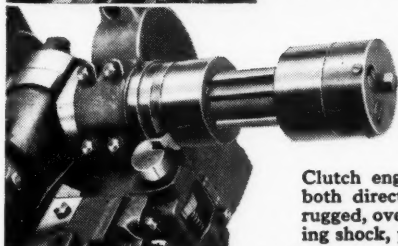
Straight Side Press Bulletin 17-B

E. W. BLISS COMPANY, TOLEDO 7, OHIO

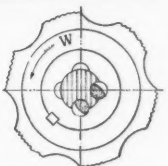
Mechanical and Hydraulic Presses, Rolling Mills, Container Machinery



Clutch disengaged—wheel running free. Clutch and locking keys are set as close as possible to shaft axis to keep impact speed at minimum.



Clutch engaged—wheel locked in both directions. Rolling action of rugged, oversize keys reduces starting shock, prevents backlash.



**BLISS BUILDS MORE TYPES AND SIZES OF PRESSES
THAN ANY OTHER COMPANY IN THE WORLD...**

**ASK ABOUT OUR NEW
DEFERRED PAYMENT PLAN**
1-3 years to pay 25% down
3 1/4% average yearly interest on
original balance. No finance charges.



ager of sales development at the company's main office in Reading, Pa., succeeding Mr. Greene in this capacity.

HILDING CARLSON has been appointed advertising and sales promotion manager for the Selas Corporation of America, Philadelphia 34, Pa., consulting and manufacturing heat process engineers.

VANADIUM-ALLOYS STEEL Co. announces the appointment of CHARLES W. WIEGEL as general manager and ROBERT E. SHOUP as general superintendent of its Colonial Steel Division, Monaca, Pa.

CHARLES E. RICE has been appointed general manager of sales by the Jessop Steel Co., Washington, Pa. He was previously manager of sales for the Pittsburgh territory.

BLACK & DECKER MFG. Co., Towson, Md., announces the removal of its Atlanta factory sales and service branch to a new building at 316 Techwood Drive, N.W., Atlanta 3, Ga.

Wisconsin

IRVING G. MEYER has been named consumer sales manager for the Power Tool Division of the Rockwell Mfg. Co., Milwaukee, Wis., and JOHN STOLARZ has been made manager of "Multiplex" radial-arm saw sales. Mr. Meyer has served for more than ten years as a district sales manager in the appliance field, and has been head of the consumer sales department since it was organized last August. Prior to joining the company last August, Mr. Stolarz held the position of sales manager with DeWalt, Inc., of Lancaster, Pa., manufacturer of woodworking machines.



ROCKWELL MFG. Co., Milwaukee, Wis., has recently acquired the rights to the automatic air hydraulic drill head formerly manufactured by the CLEVELAND REPUBLIC TOOL CORPORATION. Three different models of the unit will be manufactured in the following capacities: 1/3 horsepower, 1 1/2-inch maximum stroke; 1 1/2 horsepower, 4-inch maximum stroke; and 5 horsepower, 6-inch maximum stroke.

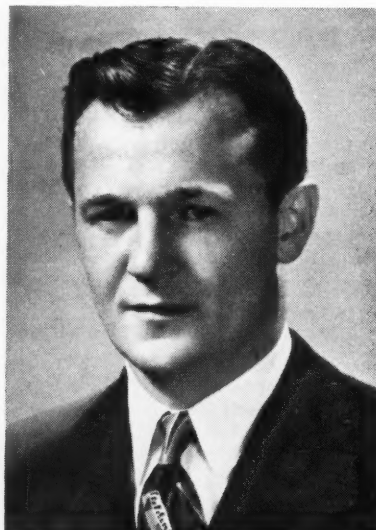
ADOLPH D. MANDL has been appointed manager of the plant of the Die-Mold Corporation, 6619 W. Motor Ave., Milwaukee 13, Wis., designer and builder of plastic molds, die-casting dies, and permanent molds. The corporation has also announced a major expansion program, including the installation of a number of new time-saving machines and equipment.

FRED L. HOPF has recently been appointed general manager of the Dynamatic Corporation, Kenosha, Wis., manufacturer of variable-speed drives, punch press drives, dynamometers, etc. Mr. Hopf was previously sales manager.

* * *

Chambersburg Announces New Die Service

Chambersburg Engineering Co., Chambersburg, Pa., has announced the establishment of a new die service for the convenience of "Cecostamp" users. In the operation of the "Cecostamp," dies poured from relatively soft metals can be used. The establishment of a zinc-alloy die foundry by the Chambersburg Engineering Co. makes a ready source of these dies available.



(Left) Irving G. Meyer, consumer sales manager, Power Tool Division, Rockwell Mfg. Co. (Right) John Stolarz, manager of "Multiplex" radial-arm saw sales

Coming Events

JANUARY 16-19—First Plant Maintenance Show in the Auditorium, Cleveland, Ohio. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

FEBRUARY 8—Panel discussion meeting of the MACHINE DESIGN DIVISION of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Schroeder Hotel, Milwaukee, Wis. Secretary of Machine Design Division, Colin Carmichael, care of *Machine Design*, Penton Bldg., Cleveland 13, Ohio.

FEBRUARY 27 - MARCH 3 — Spring meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Hotel William Penn, Pittsburgh, Pa. Executive Secretary, C. L. Warwick, 1916 Race St., Philadelphia 3, Pa.

MARCH 28-31—FOURTH NATIONAL PLASTICS EXPOSITION at the Navy Pier, Chicago, Ill. Sponsored by the SOCIETY OF THE PLASTICS INDUSTRY. William T. Cruse, executive vice-president, 295 Madison Ave., New York 17, N. Y.

APRIL 4-8—NATIONAL PRODUCTION EXPOSITION at the Stevens Hotel, Chicago, Ill. Sponsored by the Chicago Technical Societies Council, Inc. Exhibit manager, John C. Toohy, 176 W. Adams St., Chicago 3, Ill.

APRIL 5-7—Twelfth annual MIDWEST POWER CONFERENCE at the Sherman Hotel, Chicago, Ill. Sponsored by the Illinois Institute of Technology, 3300 S. Federal St., Chicago 16, Ill.

APRIL 10-14—Exposition of the AMERICAN SOCIETY OF TOOL ENGINEERS at the Convention Hall and Commercial Museum in Philadelphia, Pa. Details available upon request to the Exposition headquarters of American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

JUNE 26-30—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS AND NINTH EXHIBIT OF TESTING APPARATUS at the Chalfonte-Haddon Hall, Atlantic City, N. J. Executive Secretary, C. L. Warwick, 1916 Race St., Philadelphia 3, Pa.

* * *

Lincoln Electric Co. Gives Incentive Payments

The annual distribution of incentive payment checks to all workers of the Lincoln Electric Co., Cleveland, Ohio, amounted to \$3,005,200. A total of 1026 checks was distributed, the average incentive check amounting to \$2929.



Makers of the NEW UNIVERSAL COFFEEMATIC

POUR THEMSELVES A

YEARLY SAVING of over \$10,000.

ON ANNEALING COSTS

To pickle and anneal the body of their new coffee pot was costing Landers, Frary & Clark, makers of the famous line of Universal appliances, \$7.50 per M pieces. 5 anneals, which at first seemed necessary to produce the quality product for which Universal is nationally known, jumped the cost per M pieces to \$37.50. Universal knew this was far too high and decided to do something about it.

Their metallurgist, in cooperation with Revere, studied the problem in detail and then proved their conclusions by exhaustive tests. It was found that by using Revere copper strip in a certain temper, 4 anneals could be eliminated. Now, after a draw of $7\frac{3}{4}$ ", the copper body is annealed once then spun into its finished shape. Based on current production, this has resulted in a saving of over \$10,000.00 per year, plus an improved product. Additional savings also are realized through more simplified handling, and more economical finishing operations due to the reduction in the number of anneals.

To make such a deep draw while holding rejects to the absolute minimum would not be possible were it not for the fine quality and consistent uniformity of the gauge and temper

of the copper used. The copper body is tin plated inside, while the outside is first nickel plated then chromium plated.

Because of the nature of this appliance, which makes coffee automatically to the individual's taste, then reduces the current to keep coffee at serving temperature, Revere copper was selected for its high thermal-conductivity. This makes it possible to brew the coffee faster and keep it hot longer, thus saving on current.

Perhaps Revere Copper or some other Revere Metal can be of help in developing or improving your product—cutting your production costs. Why not tell Revere about *your* metal problems? Call the Revere Sales Office nearest you today.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.
Sales Offices in Principal Cities, Distributors Everywhere.

New Books and Publications

TESTING MACHINE TOOLS. By Dr. Georg Schlesinger. 100 pages, 8 1/4 by 11 inches. Published by the Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Sold in the United States by THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y. Price, \$4.

Complete instructions for the inspection and testing of machine tools, designed to aid engineers, designers, inspectors, and users of these machines, are contained in this book, of which this is the fifth edition. The directions cover milling and gear-cutting machines; center and turret lathes; multiple-spindle automatics; vertical boring mills; grinding machines; drilling and horizontal boring machines; shearing, punching, and stamping machines; presses; and woodworking machines.

The methods described are the result of long experience, and were adopted and fixed by the consent of the leading Continental machine tool builders, as well as users. While the instructions given are intended to be used in making trial tests of new machines, the methods are also being employed in many shops in the reconditioning and rebuilding of worn machines and in maintenance operations.

METHODS OF JOINING PIPE. By J. E. York. 236 pages, 5 1/2 by 8 1/2 inches. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y. Price, \$3; Canada and foreign, \$3.40.

The proper selection of pipe joints is comprehensively covered in this book, which illustrates and describes all types of pipe joints, including expansion joints. Every engineer concerned with piping will find this a valuable reference book.

The text is grouped into the following ten chapters: Screwed joints for ferrous and brass pipe; flanged pipe joints; welded and brazed pipe joints; methods of joining cast-iron pipe; joints for thin-wall tubes; joints for plumbing and chemical-resistant pipe; joints for vitreous tile and concrete pipe; joints for transite pipe; joints for wood pipe; and joints to permit movement. Included also are data on gasket material and applications.

OIL HYDRAULIC POWER AND ITS INDUSTRIAL APPLICATIONS. By Walter Ernst. 366 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. Price, \$6.

Designed to meet the needs of the practicing engineer, this book covers the development, theory, and prac-

tical applications of oil hydraulics. It gives examples of actual detailed calculations and designs for hydraulic components, pumps, and valves. The latest practices in hydraulic components, oil circuits and applications are covered.

The first portion of the book covers the behavior of oil under pressure, while succeeding chapters deal with the generation of oil hydraulic power by means of rotary and plunger pumps, and its utilization, control, and transmission. Considerable attention is given to practical applications of oil hydraulic power, and several circuits are illustrated and described.

RADIANT HEATING (Second edition). By T. Napier Adlam. 504 pages, 6 by 9 inches. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y. Price, \$6.

Important developments in radiant heating, radiant cooling, and snow melting, both in the United States and Europe, are covered in this book, the second edition of which has just been published. The first edition, which was published in 1947, has been expanded to include the latest information on the subject.

Material has been added to the chapter on ceiling panels to include enclosed convector panels, gravity warm air panels, and forced warm air panels. The chapter on floor panels has been increased to cover research on the physiological aspects of heated floors. Such developments as electrical rubber panels, portable electric screens, and radiant glass panels are described, and data has been added on embedding electric conductors in the plaster of ceilings and walls to form heating panels. Because of the great interest in snow melting, the chapter on this subject has been increased to cover information for those who plan to design snow melting systems.

METALS REFERENCE BOOK. Edited by Colin J. Smithells. 735 pages, 6 by 9 1/2 inches; over 400 tables and diagrams. Published by Interscience Publishers, Inc., 215 Fourth Ave., New York 3, N. Y. Price, \$13.50.

A comprehensive summary of the data relating to metallurgy and metal physics is given in this reference book. As far as possible, the material is presented in the form of tables or diagrams, the descriptive matter being kept to a minimum. The book, which is the American edition of a British publication, is the result of the combined work of the editor, seven associate editors, and a large number of contributors.

An idea of the scope of the work will be obtained by the following list of contents: Introductory Tables, including Weights and Measures, Mathematical Formulas, Temperature Conversion, and other general tables; Constants of General and Nuclear Physics; Line Spectra of the Elements; X-Ray Crystallography; Crystallography; Crystal Chemistry; Geochemistry; Metallography; Equilibrium Diagrams; Gas-Metal Systems; Diffusion in Metals; General Physical Properties; Thermodynamical Data; Thermal Conductivity; Thermoelectric Properties and Temperature Measurement; Radiating Properties of Metals; Thermionic, Photo-Electric, and Secondary Emission; Electrical Properties; Steels and Alloys with Special Magnetic Properties; Mechanical Testing; Mechanical Properties; Hard Metals; Deep Drawing Properties; Lubricants; Casting Alloys and Foundry Data; Refractory Materials; Fuels; Carbon and Graphite Electrodes; Controlled Atmospheres for Heat-Treatment; Corrosion; Polarographic Analysis; Electroplating and Metal Finishing; Welding; and Solders and Brazing Alloys.

CASE PROBLEMS IN BUSINESS AND INDUSTRIAL MANAGEMENT. By Geo. R. Terry. 170 pages, 8 1/2 by 11 inches. Published by the William C. Brown Co., Dubuque, Iowa. Price, paper-bound, \$2.50.

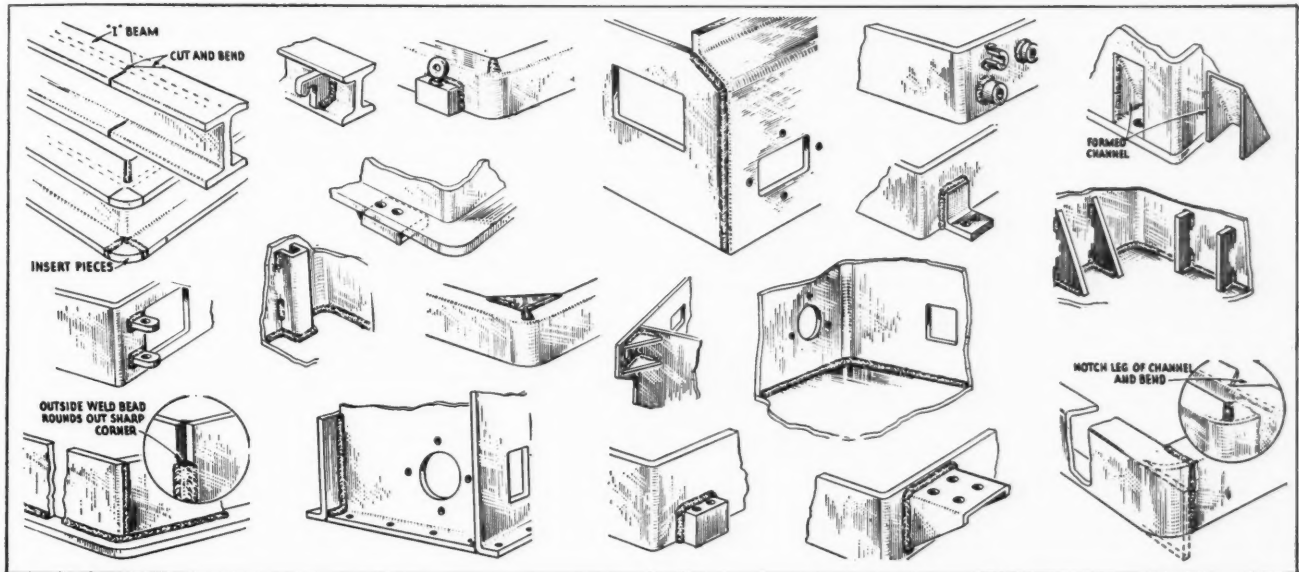
Case problems on a variety of situations encountered in business and industry are presented in this book. They are intended to provide laboratory material in which practice can be acquired in recognizing a problem, analyzing it, formulating a decision, and applying it to the specific circumstances. It is written for the student, supervisor, or executive trainee.

The cases are arranged under the major common topics in the field of management, including such subjects as scientific management, organization principles, basic management decisions, product development, standardization, equipment and machines, material-handling, lighting, air-conditioning, plant lay-out and maintenance, inspection, motion and time study, wage payment plans, production control, safety, morale, discipline, managerial costs.

THE STORY OF MAGNESIUM. By W. H. Gross. 262 pages, 5 1/4 by 7 3/4 inches. Published by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. Price, \$2.

Written in a simple, readable style, this volume is designed for the layman rather than the scientific or technical specialist, although the author is a metallurgical expert. It tells of a metal that, prior to the war, was merely a by-product of the chemical industry. The war demand

Ideas on Designing Bases for Greater Rigidity at Less Cost



Examples of simple design details for fabricating more durable machinery bases at less cost with arc welding.

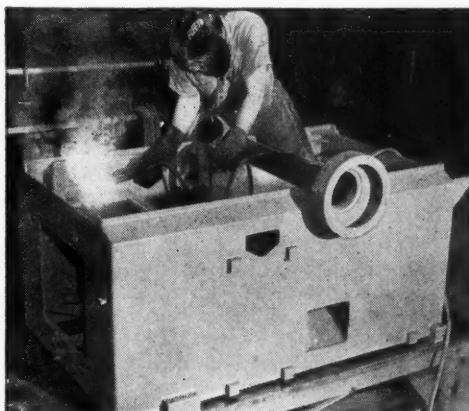
Machinery bases built from welded steel possess more than twice the rigidity per pound than cast iron. By fabricating with arc welding, manufacturers are able to incorporate many unique design features at less cost since most component parts are readily cut and formed from standard steel shapes and plate and then clamped in simple fixtures for fast, easy arc welding.

Suggested above are but a few of many design ideas that can be used to simplify the construction of machinery bases, and at the same time, achieve greater rigidity, clean, modern appearance at a remarkably low cost.

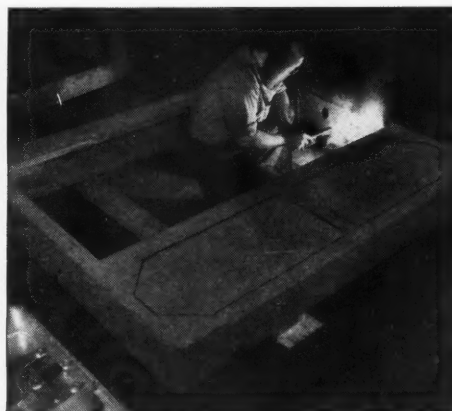
In a great many cases, plain structural shapes like steel

bars, channels, "I" beams and simple plate are used almost entirely. Where metal forming equipment is available, component parts can be bent to shape, thereby minimizing both fit-up and welding. Many components can also be pre-drilled and tapped on small, high speed equipment, eliminating the need for heavy, slower operating machine tools.

Design improvements or changes to suit customers' needs are more easily accomplished with welded design. Costs and delays of pattern changes are eliminated, thus cutting down overall production time and speeding manufacturing schedules.



Rigid All-Welded Base for planer. Side members are sheared plate reinforced with stiffeners. Courtesy Porter Machinery Company, Grand Rapids, Mich.



Clean, Modern Styled Appearance is made possible with structural shapes and plate. Base has totally enclosed reservoir for coolant storage.

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TEXT IN PATTERNMAKING. By Alexander V. Hanel. 314 pages, 6 by 9 inches. Published by the Bruce Publishing Co., 540 N. Milwaukee St., Milwaukee 1, Wis. Price, \$2.96.

This book has been written for both the student and instructor of wood patternmaking, as well as for the apprentice patternmaker and journeyman. The text is divided into two parts, the first of which presents general information on the subject as well as specific technical data; the second part consists of a variety of jobs, designed to give the student training in fundamental skills and procedures, in logically graduated sequence.

REPORTS OF THE IRON AND STEEL COMMITTEE OF THE INTERNATIONAL LABOR ORGANIZATION. Distributed by the International Labor Office, Washington Branch, 1825 Jefferson Place, N.W., Washington 6, D.C. Price for set of three, \$2.50.

This set of books contains reports of the third session of the Iron and Steel Committee of the International Labor Organization, held in Geneva, Switzerland, in November, 1949. Report No. 1 covers a general summary of the iron and steel industry; Report No. 2 deals with guaranteed wages in the industry; and Report No. 3 with technological improvements and their effects on employment.

REVIEW OF CURRENT RESEARCH AND DIRECTORY OF MEMBER INSTITUTIONS (1949). 186 pages, 6 by 9 inches. Published by the College of Engineering, State University of Iowa, Iowa City, Iowa. Price, \$1.75.

Over 4000 college and university current research projects in engineering subjects are listed by title in this book. The projects represent eighty-two educational institutions which hold membership in the Research Council. Details concerning policies governing the conduct of engineering research, personnel, expenditures, research courses, and conferences at the various institutions are given.

Obituaries



William E. O'Connor

William E. O'Connor, for forty-two years associated with the Cleveland Automatic Machine Co., Cincinnati, Ohio, died on November 14, following a heart attack, at the age of seventy-five years. Mr. O'Connor was born in Manchester, England on October 15, 1874, and went to Cherterville, Ontario, Canada, as a boy. After completing schooling at Cherterville, he came to the United States in 1895.

Mr. O'Connor became associated with the Cleveland Automatic Machine Co. in 1906. His first assignment was in the testing department, where he showed such unusual ability that he was soon promoted to the position of service engineer for the New York territory, and held this post until October, 1947, when he retired due to illness. In the passing of Mr. O'Connor, the machine tool industry has lost a friend and an able service engineer. He is survived by his wife, three sons, and four daughters.

Carter Stanard Cole

Carter Stanard Cole, assistant technical secretary of the American Society for Testing Materials, died in Philadelphia on November 17 of complications resulting from a heart attack. A native of Virginia, Mr. Cole was graduated from the University of Virginia in 1917. He served in the Navy during World War I, and from 1928 to 1942 was connected with the Copper and Brass Association, after which he went with the War Production Board in Washington and was appointed chief of the Metals Branch of the Conservation Division.

Mr. Cole had been on the A.S.T.M.

staff since October, 1944. His activities were connected largely with the work of the Society in the fields of non-ferrous metals and alloys and corrosion. In addition to his association with the A.S.T.M., he was a member of the American Society of Mechanical Engineers, the Society of Automotive Engineers, the American Institute of Mining and Metallurgical Engineers, the American Foundrymen's Society, and the Engineers Club of Philadelphia.

Harry J. Merrick

Harry J. Merrick, executive secretary of the Cutting Tool Manufacturers Association, Detroit, Mich., died suddenly on December 12 at his home in Grosse Pointe, Mich., at the age of forty-six years. Mr. Merrick was born in Scranton, Pa. He received the degree of bachelor of arts from the University of Michigan and the degree of bachelor of law from Fordham University. Mr. Merrick was engaged in general legal practice in Detroit until 1943, when he was appointed to the National War Labor Board, Region II. In 1944, when the Cutting Tool Manufacturers Association was formed, he became executive secretary.

BEN SLOAN, for thirty years representative of Pratt & Whitney Division Niles-Bement-Pond Co., at Newark, N. J., died on November 17. Mr. Sloan was born in Greenville, S. C., on August 21, 1883, and graduated from the College of Mechanical Engineering, Cornell University, in 1907. Soon after his graduation, he joined the Pratt & Whitney organization, and had a record of over forty-two years of continuous service with the organization. Mr. Sloan served his country in World War I as Captain in Ordnance at the Frankford Arsenal.

ALBERT A. CRIQUI, consulting engineer for the Buffalo Forge Co., Buffalo, N. Y., died suddenly on November 7, at the age of sixty-seven years. Mr. Criqui was born at Harris Hill on March 3, 1887. His entire engineering career was spent with the Buffalo Forge Co., starting in 1903. In 1915, he became chief engineer, which position he held until 1948, when he was appointed consulting engineer.

ALEXANDER NIMICK, SR., works manager of the Colonial Steel Division of Vanadium-Alloys Steel Co., died on November 20. Mr. Nimick was associated with the Colonial Steel Division for thirty-five years, and had been a director of the Vanadium-Alloys Steel Co. since 1932.

STANLEY T. GOSS, founder and president of the Goss & DeLeeuw Machine Co., Kensington, Conn., died on October 31.